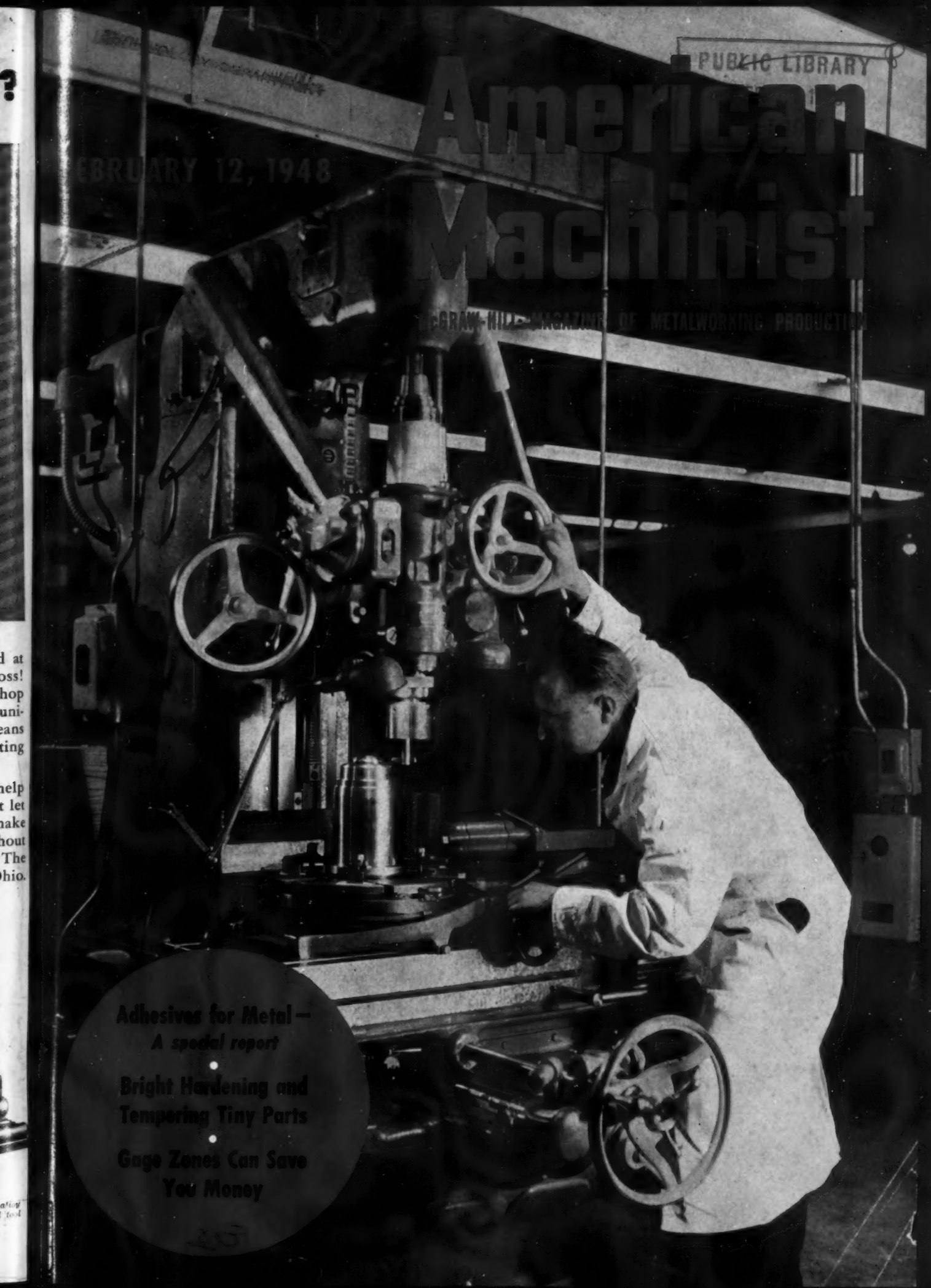
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FEBRUARY 12, 1948
Adhesives for Metal—
A special report
Bright Hardening and
Tempering Tiny Parts
Gage Zones Can Save
You Money

Simplify your small-lot grinding

on this Completely New Heald Model 271 Plain Internal

● HERE'S a brand new Heald Internal Grinder —the Model 271 Plain—that simplifies setups and minimizes changeover time between jobs. Handles straight or taper grinding and precision facing work on a wide variety of parts . . . and is especially designed for small to medium lot production runs where automatic sizing is not needed.

As in every new Heald machine, there's a wealth of research and engineering experience behind the Model 271 Plain. Many new, unique features give you:

FASTER SETUPS. Cycle feed rates and amounts set by individual graduated knobs; table stroke set by quickly adjusted self-locking reverse dogs; workhead quickly and accurately set for straight or taper work.

EASIER OPERATION. Centralized controls readily accessible without reaching; extra-sensitive handwheel provides full and effortless control of table.

MINIMUM MAINTENANCE. Isolated pump-and-tank unit pulls out from base; flared steel hydraulic tubing means leak-proof joints; electrical controls grouped in dust-proof box at rear.

For further information on the Heald Model 271 Plain, or others of the 19 all-new Heald machines, get in touch with the Heald branch office nearest you. Or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago · Cleveland · Dayton · Detroit · Indianapolis · Lansing · New York

BULLETIN AVAILABLE

listing complete features and specifications of new Model 271 Plain.

ANNOUNCING 19th NEW HEALD MACHINE

TECHNOLOGY DEPARTMENT

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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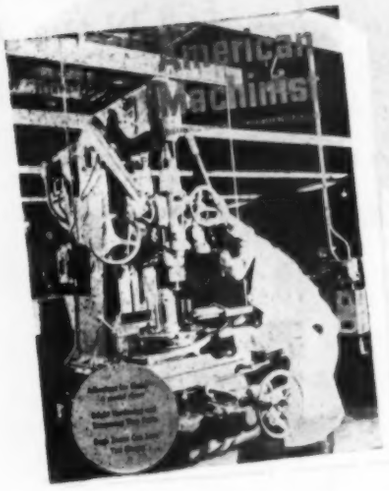


Chips and QUIPS

Our Cover . . . In the basement of the modern air-conditioned administration building of A. O. Smith Corp., Milwaukee, is an Experimental & Research Shop, with machines painted in color, operators togged out in shop coats, special lighting, and what not. This Kodachrome of the Pratt & Whitney jig borer there, shows Jess D. Bandor machining the punch for a piston forging. Hans Zielke took the picture.

Contrast . . . As our lead articles contrast heat and cold, so we balance data from Conn., with some from Calif. Associate Editor Wharen, recently back from the West Coast, provides a series of shop shots of broaching, cam cutting, gear cutting, hypermilling and grinding from the San Leandro plant of Friden Calculating Machine Co., for the first of his technical-ear-to-the-ground reports on his visits . . . And for contrast with shop practice, we have some final tips on rust and corrosion with hyraulic oils, with which Tony Zino completes his 7-part story. This matter of contrasts is important—that's the way a magazine serves reader groups, stays in balance, retains vitality.

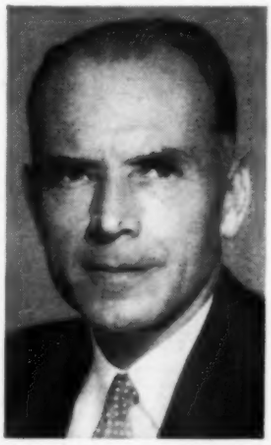
Tiny Heat Treating . . . Hardening and tempering tiny parts presents many normal problems, frequently complicated by the need to keep parts bright. Harry Hovis, works chemist, and A. W. Marks, heat-treat foreman, at Hamilton Watch Co. undertook an investigation of quenching oils and protective atmospheres to see what could be done. Here they tell how they worked out methods to retain brightness on almost microscopic pieces. Next issue, they'll complete the story.

Sticky Subject . . . For a year or more, we've planned a special report on adhesives for cementing metal to metal, glass, wood, plastics, rubber, or what have you. Various editors have toyed with the subject, but Jim Linsley finally settled solidly into the traces, and turned out the solid 12 pages herewith. Only eight were scheduled, but we felt the material he assembled deserved a 50% increase in space. . . . As usual, reprints will be available, if you need them, at 20 cents apiece.

When Doctors Disagree . . . A major wartime problem was parts that passed maker's gages, failed on Ordnance gages. John Gaillard, mechanical engineer of the American Standards Assn., found out why, turns up here with a gage zone system that protects against such disagreements. Unless you are your own customer, or have customers who never inspect incoming parts shipments, this article will repay careful study. Read about Mr. Gaillard below.

Tooling Tricks . . . American Car & Foundry has just announced a brand-new production line for freight cars at its Chicago plant, incorporating fixturized assembly, automatic welding and so on. Here, in pictures and captions, is the story . . . There's also a picture story of some good automatic fixtures and drill units at Odin Stove, up Buffalo way . . . Short Cuts and Practical Ideas also provide tooling tricks you can use.

Coming . . . Feb. 26 *A.M.* likewise draws on many sources for its content. We start a new 7-article series on getting the most from punch presses, by General Electric's man charged with the job, also a 3-article series by Fred C. Victory, chief engineer of Moore Special Tool, on dimensional instability . . . Harry Wharen provides two more reports from his West Coast trip, one on methods of wheel manufacture by Norris Stamping & Mfg. Co., the other a control method used by Axelson in its lathe manufacturing (since sold, but the method is worth telling about nonetheless) . . . Chester Ricker gives uptodate pointers on cold heading, Harry Hovis and A. W. Marks finish their 2-part series on bright hardening and tempering tiny parts, and there's something on cutting gears too . . . Our special report deals with finishing copper and its alloys, is an extract of the forthcoming ASM Handbook. With Dr. Lyman's permission (editor of the book) we present this preview.



STANDARDS MAN . . . John Gaillard heads the ASA mechanical engineering staff and is secretary of its Mechanical Standards Committee. He holds the degrees of mechanical engineer and doctor of technical science of the Institute of Technology, in Delft, The Netherlands. The latter was awarded for his basic study of industrial standardization, later published in the U.S. under the title "Industrial Standardization, Its Principles and Applications."

In the Netherlands Dr. Gaillard, after working in industry, was a patent attorney and later the associate director of the Central Standards Bureau. He was associated with Dr. Frank B. Gilbreth as a consulting engineer on problems of industrial management, and since 1924 has been with the ASA. He is lecturer at Columbia Univeristy for the post-graduate course on industrial standardization. He is a member of the ASME and the Society for Advancement of Management.

A COMPLETE UNIT FOR CONIFLEX GEAR PRODUCTION

FOR TESTING

GLEASON STRAIGHT BEVEL GEAR EQUIPMENT

FOR SHARPENING

FOR CUTTING

GLEASON
NO. 13 UNIVERSAL TESTER

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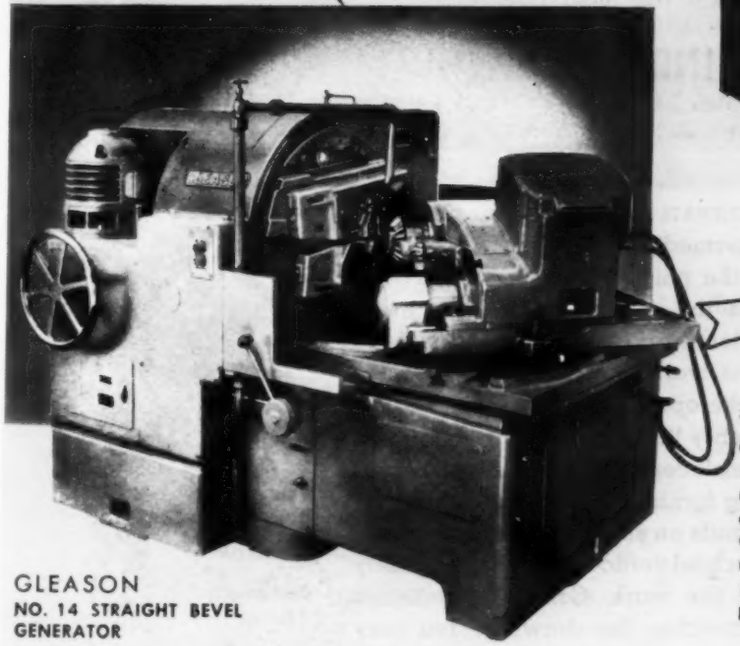
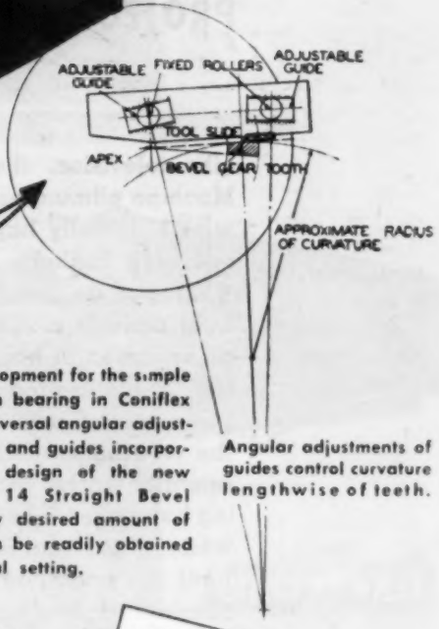
NO. 12 GENERATOR TOOL SHARPENER

* Coniflex—Straight bevels with localized tooth bearing. Reg. U. S. Pat. Off.



GLEASON
NO. 14 STRAIGHT BEVEL GENERATOR



Angular adjustments of guides control curvature lengthwise of teeth.

The latest development for the simple control of tooth bearing in Coniflex gears is the universal angular adjustments of rollers and guides incorporated into the design of the new Gleason No. 14 Straight Bevel Generator. Any desired amount of localization can be readily obtained by a rapid dial setting.

The Gleason Unit for Coniflex Gear Production combines the many advantages of the new Gleason No. 14 Straight Bevel Generator . . . faster cutting . . . positive control of tooth bearing . . . simplicity of operation . . . with the ease of accurate sharpening of cutting tools on the No. 12 Generator Tool Sharpener. Continuous testing on the No. 13 Universal Gear Tester before, during and after cutting assures not only uniform production but simplifies final assembly by pre-establishing the best running position of the gears.

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over Eighty Years

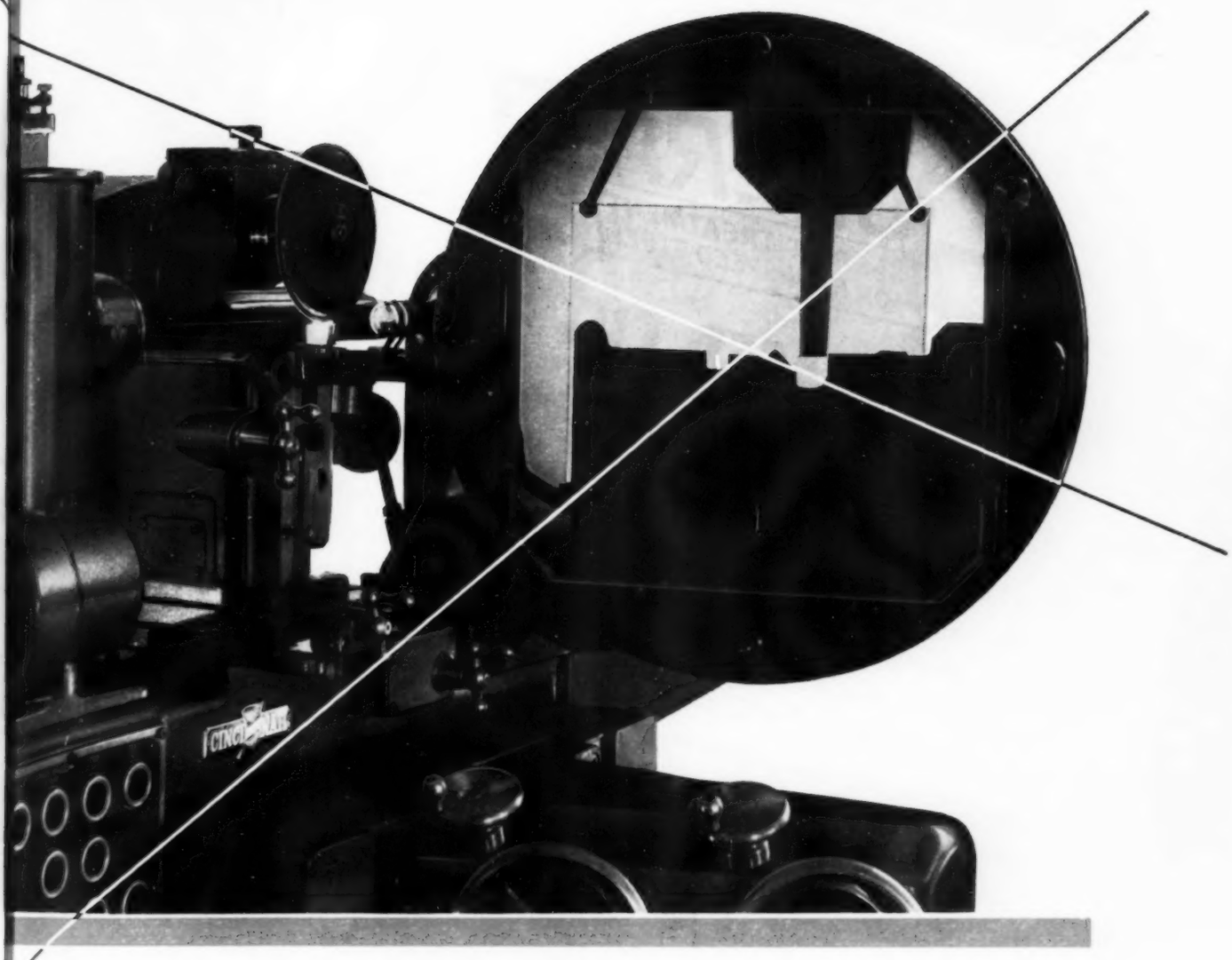
You can see accuracy in the making

ON THE NEW CINCINNATI PROJECTO-FORM GRINDING MACHINE

Like television, the new CINCINNATI Projecto-Form Grinding Machine eliminates a lot of intermediate steps and shows you what's actually happening at the point of action. And it goes one step further... it enlarges the original object 20 times. ¶Through an arrangement of lenses and a mirror, an intense light projects a silhouette of the work and wheel to a ground glass screen in front of which the operator is seated. A "drawing" of the desired contour, twenty times size, is cut on a glass plate coated with a tinted translucent emulsion. Mounted on the viewing screen, the drawing furnishes a guide to which the operator works. With his two hands on small micrometer adjusting handwheels, he adjusts the wheel vertically and transversely while it is reciprocating over the work. Grinding continues until the image of the work matches the drawing. You may obtain complete specifications by writing for catalog M-1612.

THE CINCINNATI MILLING

MILLING MACHINES



CINCINNATI Projecto-Form Grinding Machine

Standard projection lens..... 20X

Special projection lens..... 40X

Standard width of grind, one setting ..... .9"

Maximum longitudinal adjustment 4½"

Complete specifications in catalog M-1612

CINCINNATI

MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

SUPERITE

The POST TREATMENT FOR HIGH-SPEED STEEL

FOR INCREASED CUTTER LIFE

. . . a notable development by Fellows

"Superite", represents a new treatment to cutting tools that greatly increases tool life, lowers costs and results in an overall saving in productive machine time. Superite-treated cutters are sharpened in the normal fashion—but less frequently, and with less stock removal per sharpening. Re-sharpening in no way affects the life of the cutting tool. The process is exclusive with Fellows, and is performed only at the Fellows plant in Springfield, Vermont.

110% Increase in Cutter Life

Material: S.A.E. 1024

Steel forging, normalized 1600°F. Brinnell hardness at cutting: 170-196. 23 teeth, 10 normal pitch, 14° normal pressure angle, 42°-36'-30" helix angle, 1-inch face width.

99% Increase in Cutter Life

Material: S.A.E. 3157

Steel forging, normalized 1600°F. Brinnell hardness at cutting: 170-196. 16 teeth, 9.25 normal pitch. 16°30' normal pressure angle, 35°-56'-14" helix angle, .845-inch face width.

GEAR SHAPERS · THREAD GENERATORS · CUTTERS · SHAVING AND BURNISHING MACHINES

Now... 50% to 100% more gears per cutter

64.9% Increase in Cutter Life

Material: S.A.E. 4640

Steel forging, Brinnell hardness at cutting 197-210. 14 teeth, 9.3459 normal pitch, 17°-18'-26" normal pressure angle, 31°8' helix angle, ¾-inch face width.

The above figures represent actual performance tests of SUPERITE-Treated Cutters in customers' plants. Comparable results can be expected under other users' operating conditions.

This increased cutter life is an added advantage to the traditional greater accuracy and larger number of gears per cutter sharpening, obtained from Original Fellows Cutters.

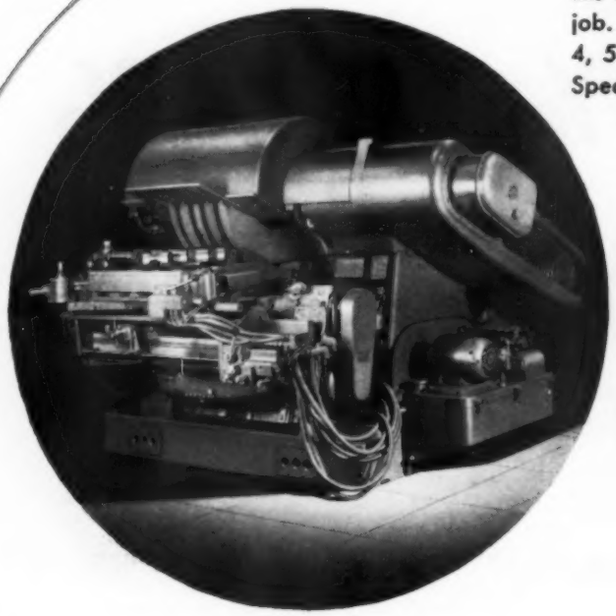
SUPERITE-Treated Cutters and Tools, though slightly higher in initial cost, represent a substantial saving in that they produce a greater number of gears per sharpening, and per total cutter life. Arrangements for cutting tests in your plant can be made through the Fellows office nearest you.

Fellows

THE FELLOWS GEAR SHAPER COMPANY

Head Office and Export Dept., Springfield, Vermont. Branch Offices: 616 Fisher Bldg., Detroit 2. 640 West Town Office Bldg., Chicago 12. 7706 Empire State Bldg., New York 1.

GEAR MEASURING AND INSPECTION INSTRUMENTS · PLASTICS MOLDING MACHINES



Cincinnati Grinders Incorporated offers you the right size of FILMATIC Centerless for your job. They are built in six sizes: Nos. 0, 2, 3, 4, 5 and 6. The No. 5 size is illustrated here. Specifications available on request.

There are

• Stop and go plays hob with production. Whenever it can be avoided, you can be sure that costs will tumble. How this was accomplished in a piston manufacturing line is illustrated at the right. The machine is a CINCINNATI FILMATIC No. 5 Centerless Grinder, equipped with a miniature highway to production . . . a horseshoe conveyer line which returns the pistons to the operator at his working position. With his left hand, he starts the pistons on the initial leg of their journey between the wheels; with his right hand, he returns them to the conveyer line. What could be more simple in reducing the cost of precision grinding? ¶ The CINCINNATI FILMATIC No. 5 Centerless Grinder offers much in any shop where large parts are ground, or where it is necessary to grind away an unusually heavy stock allowance. They have a capacity of 1" to 7" diameter work; thrufeed or infeed; up to 36" width of wheel; up to 50 hp grinding wheel motor; may be operated as isolated equipment or as part of a production line. And like other CINCINNATI Centerless Grinders, the No. 5 offers all the advantages of FILMATIC grinding wheel spindle bearings . . . self-adjusting; they run for years without maintenance; they keep things moving on the highway to production. Additional data on the No. 5 FILMATIC Centerless may be obtained by writing for specifications.

CINCINNATI GRINDERS

CENTER TYPE GRINDING MACHINES

no STOP SIGNS

. . . on this HIGHWAY to PRODUCTION

CINCINNATI

INCORPORATED CINCINNATI 9, OHIO, U. S. A.

CENTERLESS® GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Gives

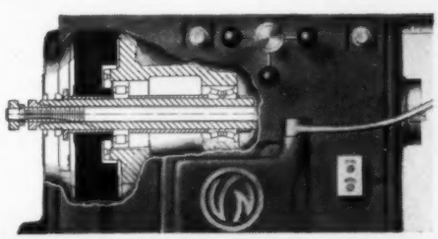
VAN NORMAN

No. 2 HEAVY

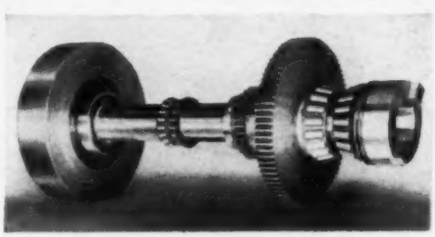
Horizontal Milling Machine

You 4 Outstanding Features

That Improve Cutability, Simplify Operation, Increase Production

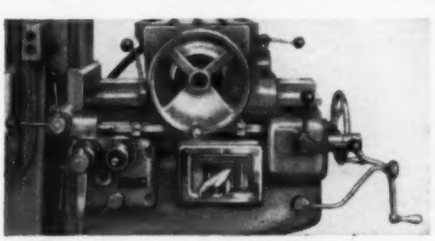


BUILT-IN SPINDLE FLYWHEEL, mounted inside the column, assures uniform uninterrupted transmission of power to cutter. The heavy flywheel increases and improves cutability . . . permits smoother finish of work surface.



5 ANTI-FRICTION BEARINGS support the large diameter alloy steel spindle. They maintain accuracy by assuring maximum spindle strength and rigidity under every type of cut.

EASE OF SPINDLE CONTROL is assured with single lever feed selector and convenient spindle reverse. Spindle clutch lever for starting and stopping spindle is quickly adjusted to most convenient operating position.



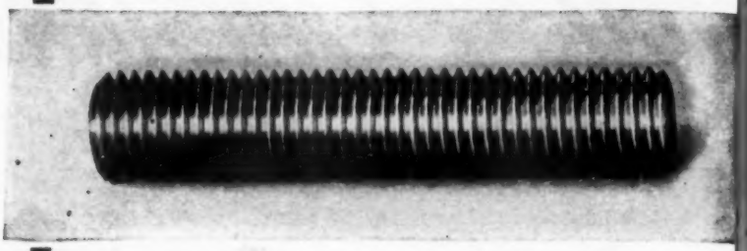
FRONT AND REAR CONTROLS of finger-tip power and six-way rapid traverse levers and manual adjustments simplify operation . . . reduce worker fatigue. Directional power controls provide maximum work and operator safety.

Look into the Van Norman No. 2 Heavy for general purpose and production milling. This heavy, rugged, highly efficient machine will give maximum quality service, increase production, lower costs on a wide variety of applications. Available with plain or universal saddle. Write for information.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS

CENTERLESS THREAD
by the *"THRU-FEED"*

210 STUDS PER HOUR

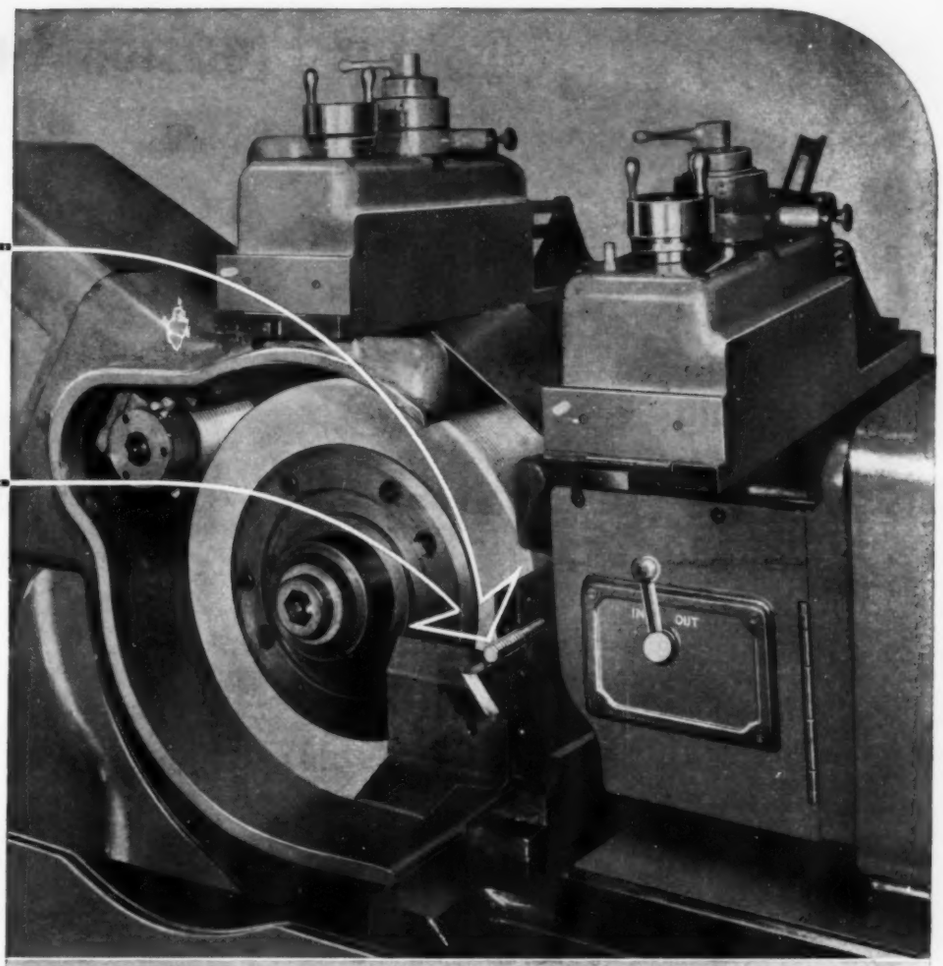


LANDIS NO. 1 CENTERLESS
THREAD GRINDING MACHINE

LANDIS Machine COMPANY
WAYNESBORO · PENNA · U.S.A.

GROUND METHOD

Name of Part	Stud
Thread Specifications:	
Diameter	3/4"
Pitch	10 USF
Thread Length	4"
Thread Tolerance	Class 7
Production Per Hour	210



The LANDIS No. 1 Centerless Thread Grinder is designed to grind screw threads on straight cylindrical workpieces and headed or multiple diameter parts.

Workpieces without interfering shoulders requiring threads on the maximum diameter only — headless set screws, continuously threaded studs, etc.—pass through the machine in a continuous flow (as illustrated) with no time lost for loading or unloading. The "thrufeed" method will grind 1/16" to 4 3/4" diameter threads to unlimited lengths.

Headed or shouldered workpieces—cap screws, stripper bolts, etc.—are placed between the wheels one at a time and ejected automatically. The thread is ground in about 1 1/2 revolutions of the part and close-to-shoulder threads are permitted. The "infeed" method will grind 1/16" to 4 3/4" threads up to 7 3/4" in length.

Either process will grind threads from the solid or finish grind precut threads. Most types of thread forms can be ground to any required class of fit and for right or left hand threads.

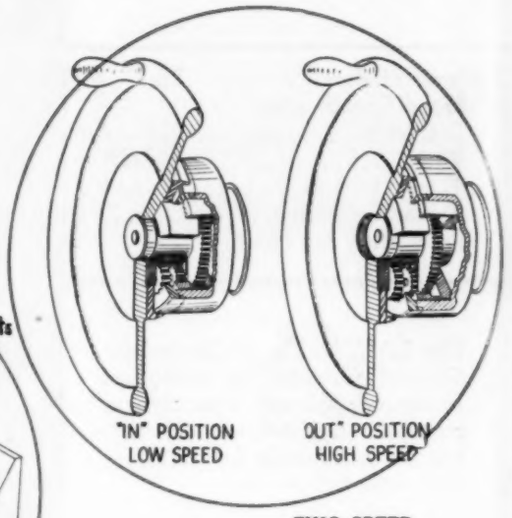
Write for Bulletin E-97

LANDIS
REG. U.S. TRADE MARK PAT. OFF.

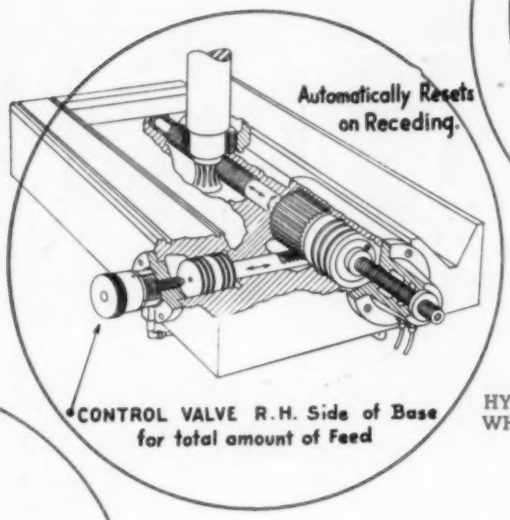
for Precision Grinding Results

straight cylindrical / taper / shoulder / profile

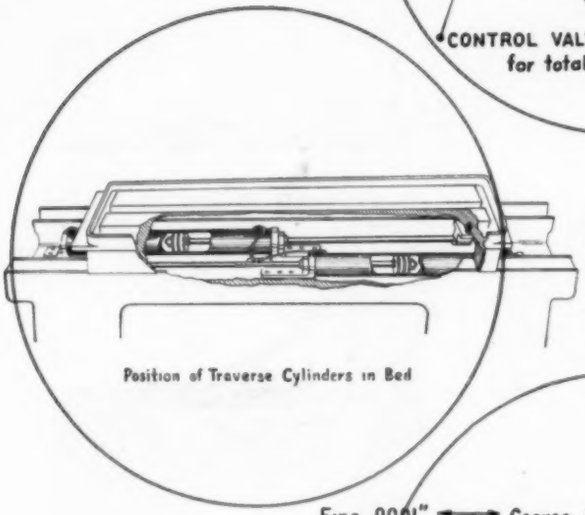
these outstanding design features



TWO SPEED
HAND TRAVERSE

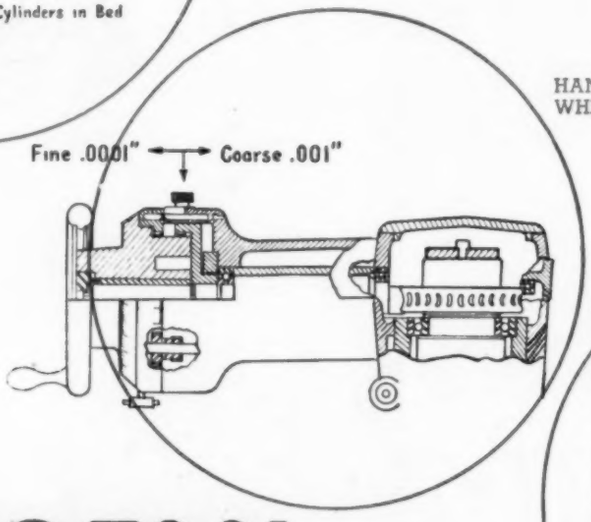


HYDRAULIC
WHEEL FEED

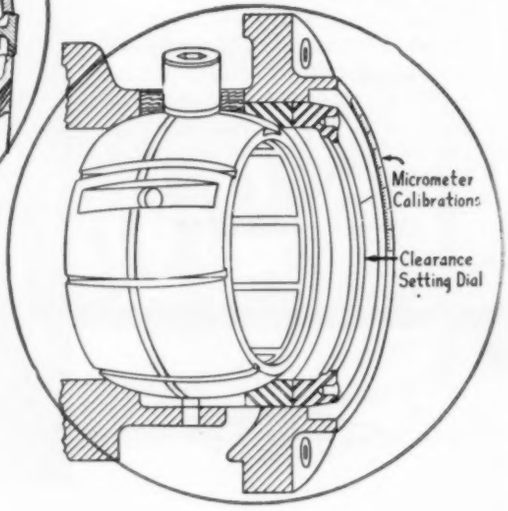


HYDRAULIC TABLE
TRAVERSE

HAND AND AUTOMATIC
WHEEL FEED



MICROSPHERE WHEEL
SPINDLE BEARINGS



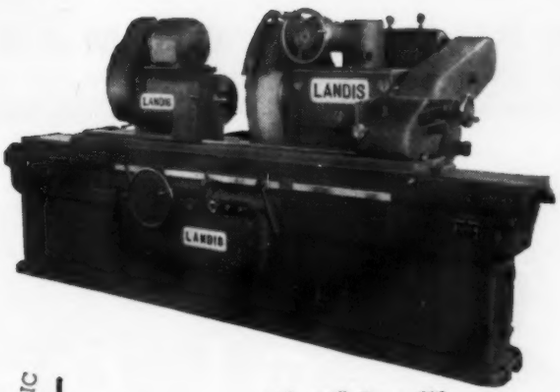
LANDIS TOOL
Precision Grinders

in Job Shop - Tool Room - Volume Production

low unit cost / fine finishes / close tolerances

4" Type H

LANDIS TOOL plain hydraulic grinders



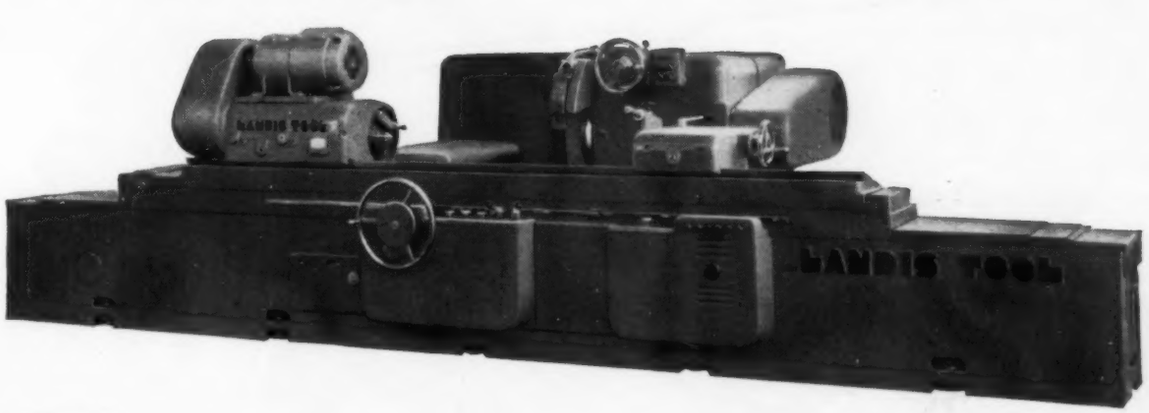
10"—14" Type CH

check the features

	TWO SPEED HAND TRAVERSE	*HYDRAULIC WHEEL FEED	HYDRAULIC TABLE TRAVERSE	HAND AND AUTOMATIC WHEEL FEED	MICROSPHERE WHEEL SPINDLE BEARINGS
4" Type H	✓	✓*	✓	✓	✓
6" Type CH 10" Type LCH	✓	✓*	✓	✓	✓
10"—14" Type CH	✓	✓*	✓	✓	✓
14"—16" Type F		✓*	✓	✓	✓

* Hydraulic straight infeed available as optional equipment.

6" Type CH



14"—16" Type F

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.

LINK-BELT Ball and Roller Bearings

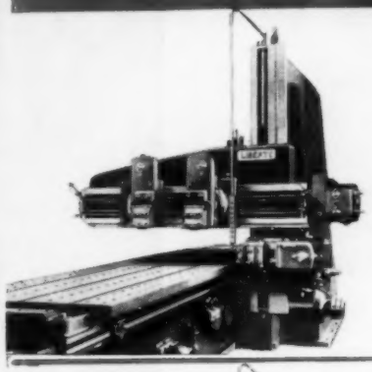
The Link-Belt Line of Self-Aligning Ball and Roller Bearings is *complete*, and you will have no difficulty in selecting the proper bearing in mounted and unmounted types (from Books 2094, 2095 and 2196 sent upon request) for all general industrial use. For use of ball and roller bearings as an integral part of machine design and construction, we invite you to discuss your problems with our engineers.

LINK-BELT COMPANY

Indianapolis 6, Chicago 9, Philadelphia 40, Pittsburgh 19, Atlanta, Dallas, Cleveland 13, Minneapolis 5, San Francisco 24, Houston 2, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 10,943

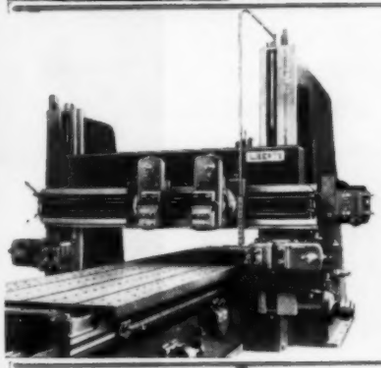
LIBERTY

BUILDS 3 *great* PLANERS



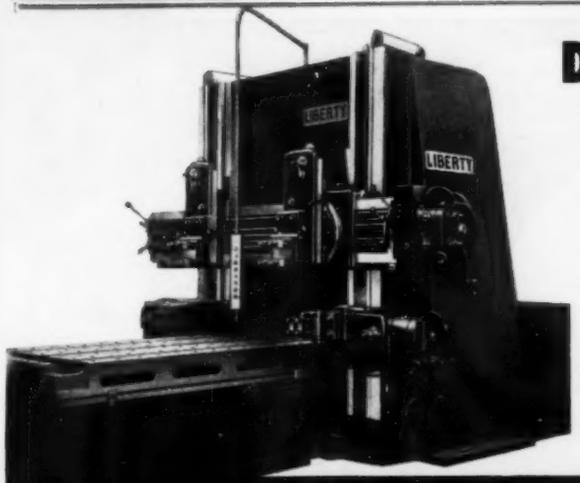
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

Write for catalog giving complete details.

All lengths, 24" x 24" wide and larger.

LIBERTY PLANERS, INC.

HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

32 ALUNDUM®...

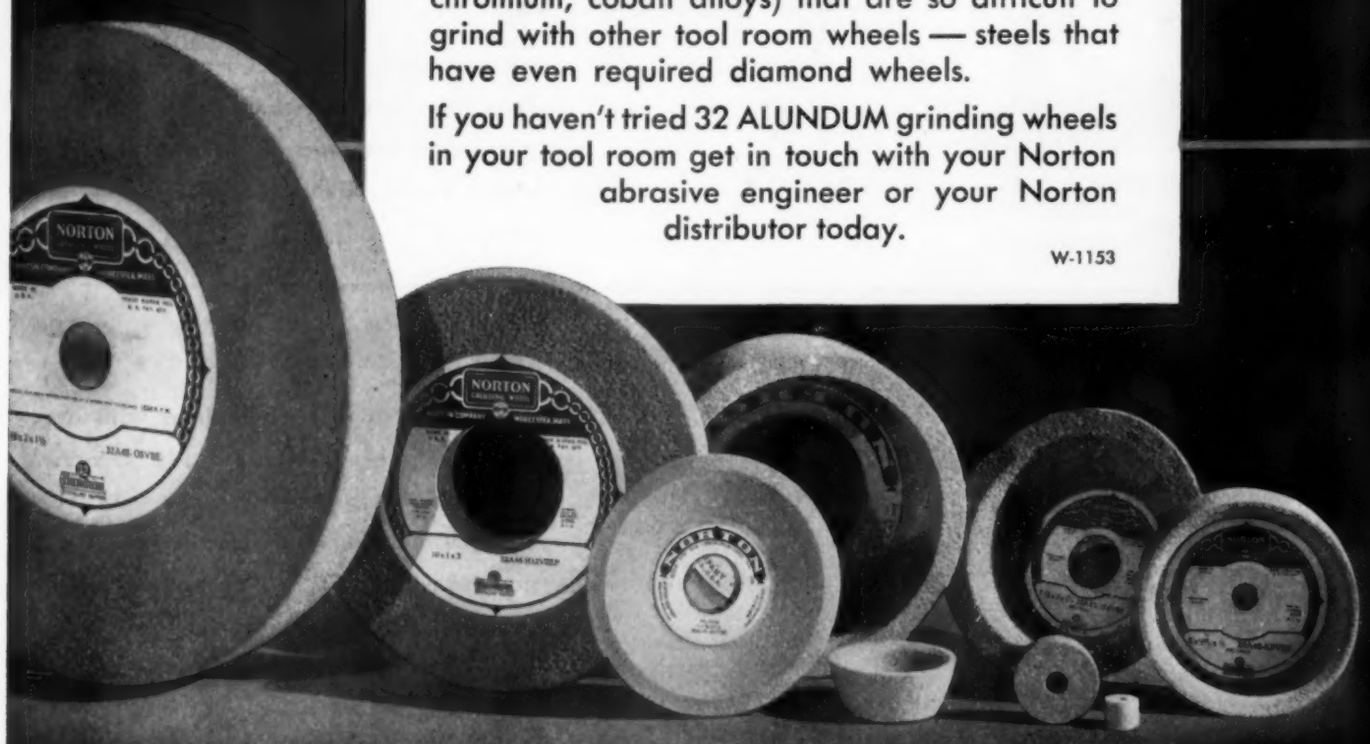
Fast Cutting . . . Cool Cutting
Few Dressings . . . Long Life

32 ALUNDUM abrasive gives you these four features in a far greater degree *than any other abrasive* — because it's made differently by a Norton-developed and patented process. Its unique single-crystal grains are *sharper* — they penetrate hard, tough high speed steels more easily — cut faster and cooler.

32 ALUNDUM wheels, for example, will grind the new "super" high speed steels (tungsten, chromium, cobalt alloys) that are so difficult to grind with other tool room wheels — steels that have even required diamond wheels.

If you haven't tried 32 ALUNDUM grinding wheels in your tool room get in touch with your Norton abrasive engineer or your Norton distributor today.

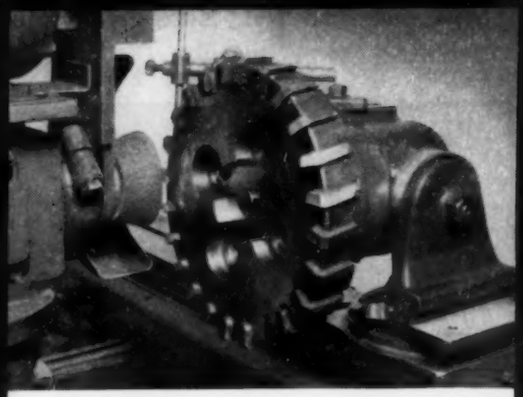
W-1153



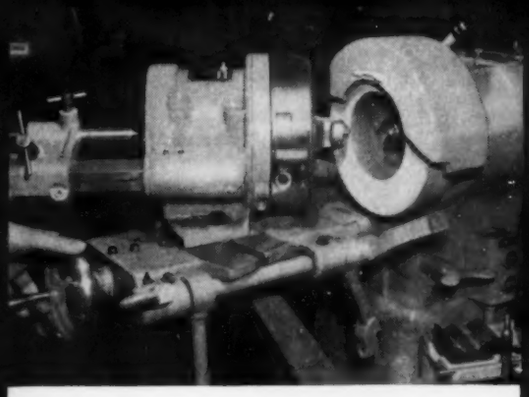
NORTON ABRASIVES

Abrasives · Grinding Wheels · Grinding and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Norbide Products · Labeling Machines

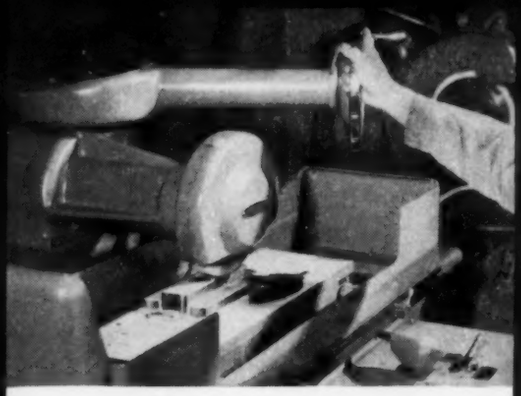
. . . Outstanding for TOOL ROOM GRINDING!



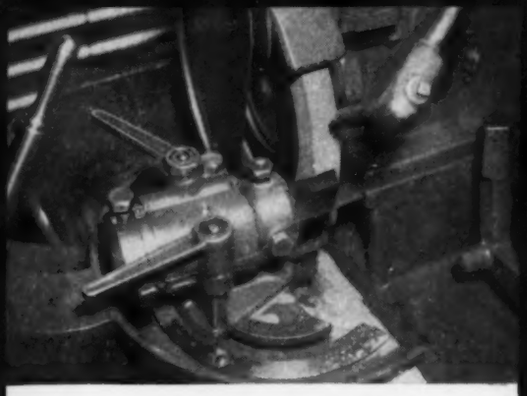
Because they stay sharp without frequent truing "32" wheels are ideal for multi-tooth cutters — will hold size all the way around without burning. Suggested specification: 32A46-K5VBE.



The cool cutting action of "32" prevents burning of sensitive H. S. S. drills and its versatility simplifies the grinding of a variety of sizes. Suggested specification for medium and large drills: 32A46-M5VBE.



"32" wheels give the extreme precision necessary for tool room surfacing jobs and they give it faster — with feeds several times greater than you've done before. Suggested specifications: 32A46-H8VBE or 32A60-F12VBEP.

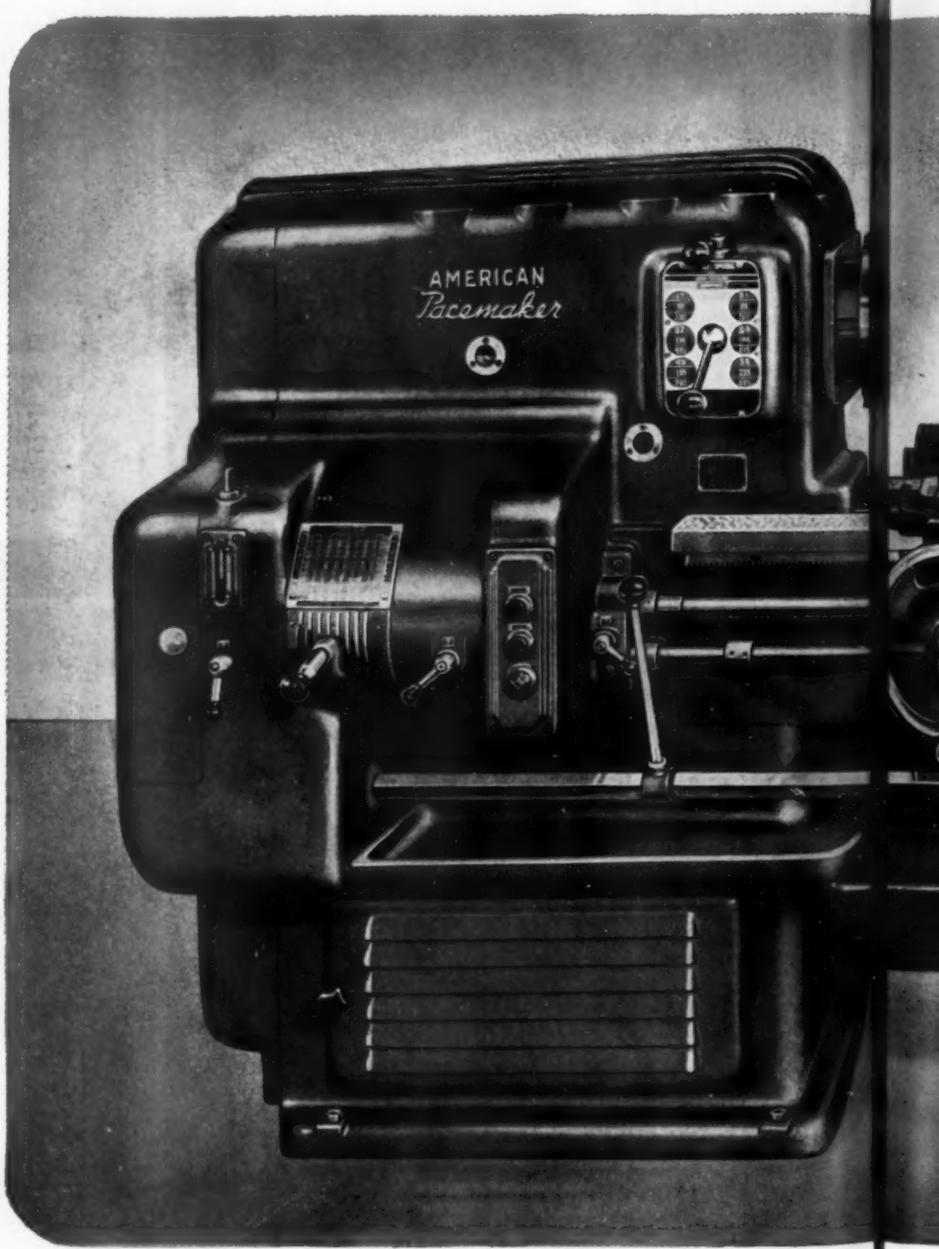


You'll find "32" wheels the fastest cutting you've ever used for single point tools — whether you sharpen offhand or by machine. Suggested specifications: offhand 32A30-05VBE (roughing), 32A60-M5VBE (finishing); machine 32A36-L5VBE.

NORTON COMPANY, WORCESTER 6, MASS. *Distributors in All Principal Cities*

NOW A NEW

THIS 18-INCH "AMERICAN" PACEMAKER LATHE is a new addition to the Pacemaker line and is streamlined for greater adaptability to the need for this size of lathe.



HIGH LIGHTS OF PACEMAKER EXCELLENCE

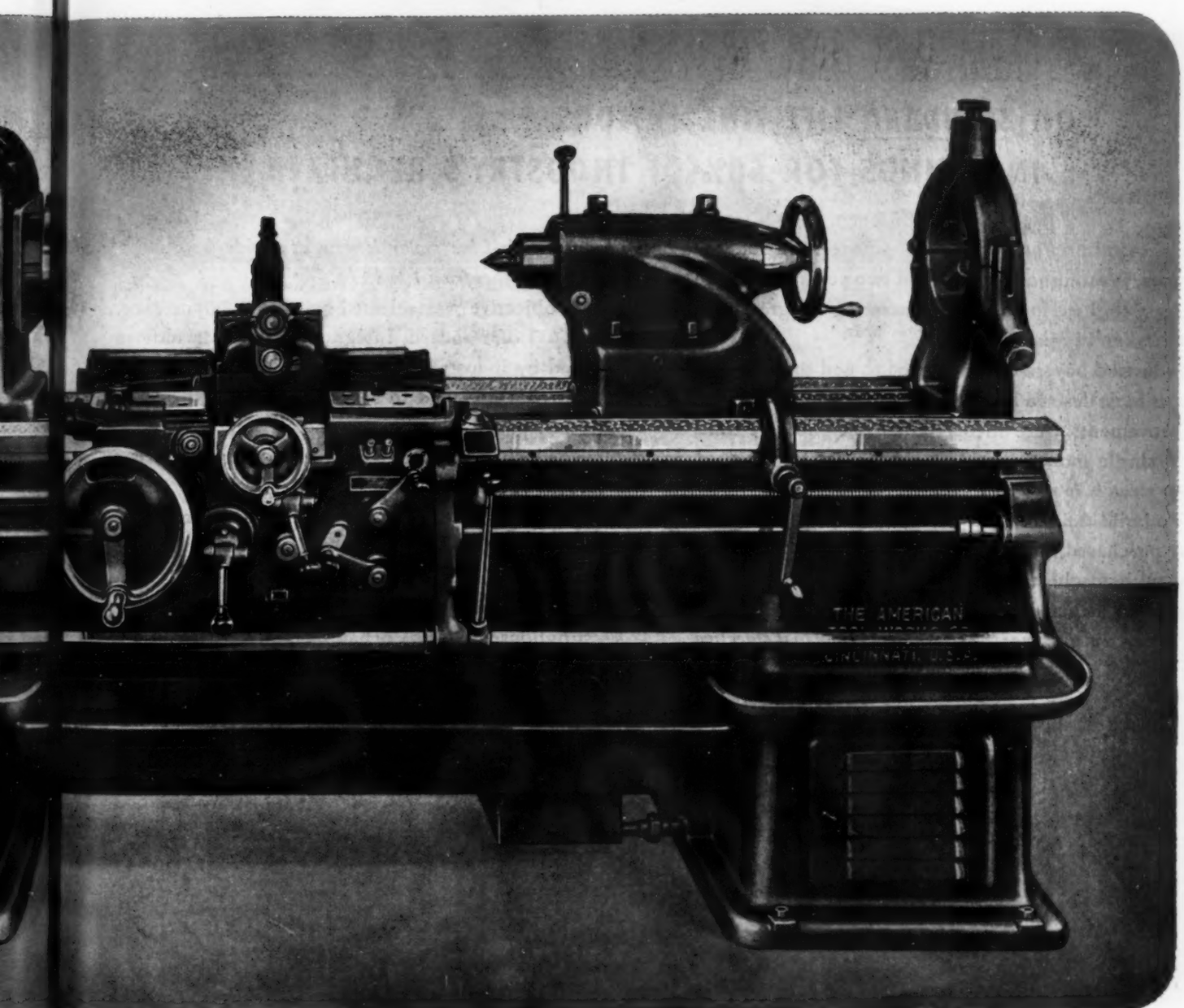
1. Basically designed for use of cemented carbide cutting tools.
2. Proportioned for full overload of 15 horse power motor.
3. Generously proportioned with metal correctly distributed to insure continuous service at maximum loads with dependability and with maintenance of original alignment.
4. Three optional speed ranges provided so customer may select the range best suited to his requirements. Each range provides 18 or 27 spindle speeds in geometrical progression with suitable speeds for all classes of lathe operation from large boring to high-speed turning with cemented carbide tools.
5. Spindle has three bearings: precision Timken at front and center and floating ball bearing at rear. Front and center bearings are adjustable by thousandths from outside of head.
6. The additional rigidity provided by center bearing insures minimum spindle deflection under heavy stresses, thus maintaining pitch line contact of driving gears resulting in longer life of gears and bearings.
7. All transmission gears in head are hardened and ground. All drive shafts are hardened, multiple splined and ground. Entire head mechanism is automatically oiled with clean filtered oil by a pump circulating system.

BULLETIN No. 16 gives a complete description of the numerous advantages offered by this new "AMERICAN" Pacemaker Lathe.

THE

PACEMAKER

AT YOUR SERVICE



AMERICAN TOOL WORKS CO., Cincinnati, Ohio, U. S. A

LATHES AND RADIAL DRILLS

NEW *Life-Line* MOTORS NOW AVAILABLE

WESTINGHOUSE NOW OFFERS *IMMEDIATE DELIVERY* ON *STANDARD* LIFE-LINE MOTORS . . . IN RATINGS FOR 60% OF INDUSTRY'S REQUIREMENTS

To meet industry's urgent need for more—and better—motors, Westinghouse embarked two years ago on the biggest engineering and manufacturing program ever undertaken in this field.

Industrial buyers were surveyed to find the improvements most desired in existing standard motors. These improvements were incorporated, for the first time, in a single motor—the Life-Line—*a motor designed, from scratch, to user specifications.*

To build the Life-Line motor, a complete new plant was purchased, tooled and equipped from the ground up, with machines and new techniques never used before to manufacture motors.

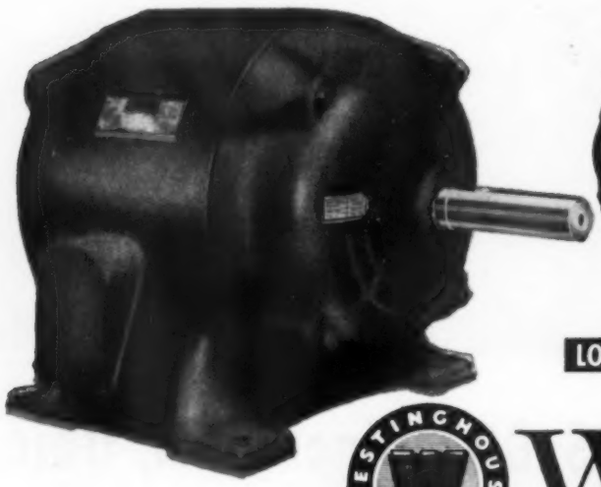
Today, we announce the attainment of our first objective.

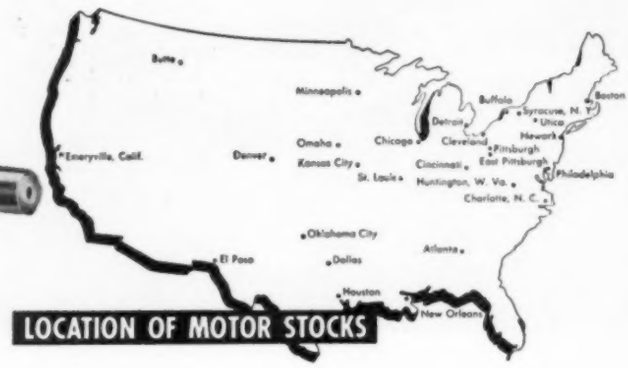
The new Life-Line motor is now available from stock, in standard types from 1 to 15 hp.

This objective was selected as of first importance, since 60% of standard, integral horsepower motors required by industrial users fall in this classification. Motor types included in stock are described on the opposite page. On "near-standard" motors, also described, short deliveries are available in these sizes.

Improved deliveries on special types and larger ratings will be the subject of future announcements, as quickly as increased output makes them possible. Watch for them . . . phone your orders from this stock list to your nearest Westinghouse representative. Westinghouse Electric Corp., Box 868, Pittsburgh, Pa.

J-21447-A





WESTINGHOUSE

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FROM 1 to 15 HP FROM STOCK

WHAT IS MEANT BY "STANDARD" MOTORS

"Standard" motors include drip-proof, splash-proof, totally-enclosed, fan-cooled and some totally-enclosed, non-ventilated complete motors, ball-bearing type, having standard electrical characteristics (220/440 volt, 2 or 3-phase, 50 or 60-cycle, standard speed torque and time-temperature characteristics).

Available from stock in ratings indicated below. Very short delivery on any standard non-stock rating in these frame sizes.

TYPES INCLUDED AS "NEAR-STANDARD" MOTORS

"Near-standard" motors are those with minor modifications, which include such items as double shaft extensions, NEMA standard B and C flanges, special No. 1 insulation, round frame, conduit box opposite standard, squeeze connectors instead of conduit box, TENV motors, partial motors, 50-cycle, 40° C. rise open motors, etc.

Short delivery in frame sizes listed below.

Life-Line A-C, Single-Phase, 60-Cycle, 110-220-Volt, Heavy-Duty Type CAP Capacitor-Start, Induction-Run Motors

HP	RPM	FRAME	VOLTS	IN STOCK
1	1750	203	220	✓
1½	1750	204	220	✓
2	1750	224	220	✓
3	1750	225	220	✓

Life-Line A-C, 3-Phase, 60-Cycle, Squirrel-Cage Motors

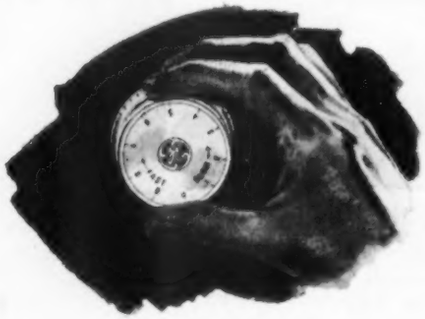
HP	RPM	Frame	Volts	ENCLOSURE TYPES IN STOCK		
				Drip-Proof	Splash-Proof	Totally Enclosed
½	860	204	220/440	✓		✓
¾	1150	203	220/440	✓		✓
	1150	203	550	✓		✓
	850	224	220/440	✓		✓
1	1750	203	220/440	✓		✓
	1150	204	220/440	✓		✓
	850	225	220/440	✓		
	850	225	550	✓		
1½	3450	203	220/440	✓	✓	
	1750	204	220/440	✓		✓
	1150	224	220/440	✓		✓
	860	254	220/440	✓		
2	3450	204	220/440	✓		
	3450	204	550	✓		
	1750	224	220/440	✓	✓	✓
	1750	225	220/440			✓
	1150	225	220/440	✓	✓	✓
	860	254	220/440	✓		✓
	860	254	550	✓		
	710	284	550	✓		
3	3450	224	220/440	✓		
	3450	224	550	✓		
	1750	225	220/440	✓	✓	✓
	1750	225	550			✓
	1135	254	220/440	✓	✓	✓
	875	284	220/440	✓		
5	3450	225	220/440	✓	✓	
	1735	254	220/440	✓	✓	✓
	1735	254	550	✓		
	1200	284	220/440	✓	✓	✓
	875	324	220/440	✓		
7½	3470	254	220/440	✓		
	1740	284	220/440	✓	✓	✓
	1740	284	550	✓		✓
	1160	324	220/440	✓		
	865	326	220/440	✓		
10	3500	284	220/440	✓	✓	
	1740	324	220/440	✓		✓
	1740	324	550			✓
	1155	326	220/440	✓	✓	
	870	364	220/440	✓		
15	3500	324	220/440	✓		
	1750	326	220/440	✓	✓	
	1160	364	220/440	✓		
	1160	364	550	✓		
	875	404	220/440		✓	

Subject to prior sale.

Life-Line motors

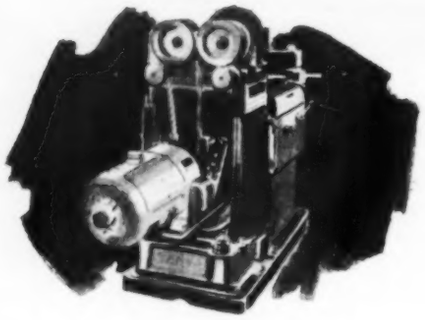
MORE PRODUCTIVE POWER FOR INDUSTRY

dial any speed . . .



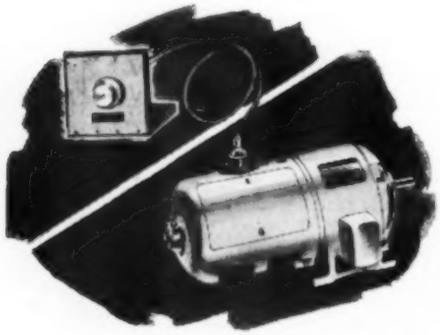
At the twist of a dial, the new Tri-Clad Type ACA induction motor will operate at any speed over a 3 to 1 range! What's more, it will do it while running on alternating current — without any converting equipment or mechanical devices whatsoever. It changes speed quickly and smoothly. In fact, wherever an adjustable-speed drive will improve quality or quantity of output, the Tri-Clad Type ACA induction motor may be a simple, economical solution.

for any machine . . .



The list of applications to your right is only a glimpse at the hundreds of potential uses where this new Tri-Clad adjustable-speed motor might well be considered. Its simplicity and ease of Installation make it an easy motor to fit to the job. Standardized NEMA dimensions are used so *there are no new mounting problems.* Its overall length is only slightly more than a constant-speed motor of comparable rating. And for the work it does, the Type ACA is one of the lightest motors in its field.

from any location!



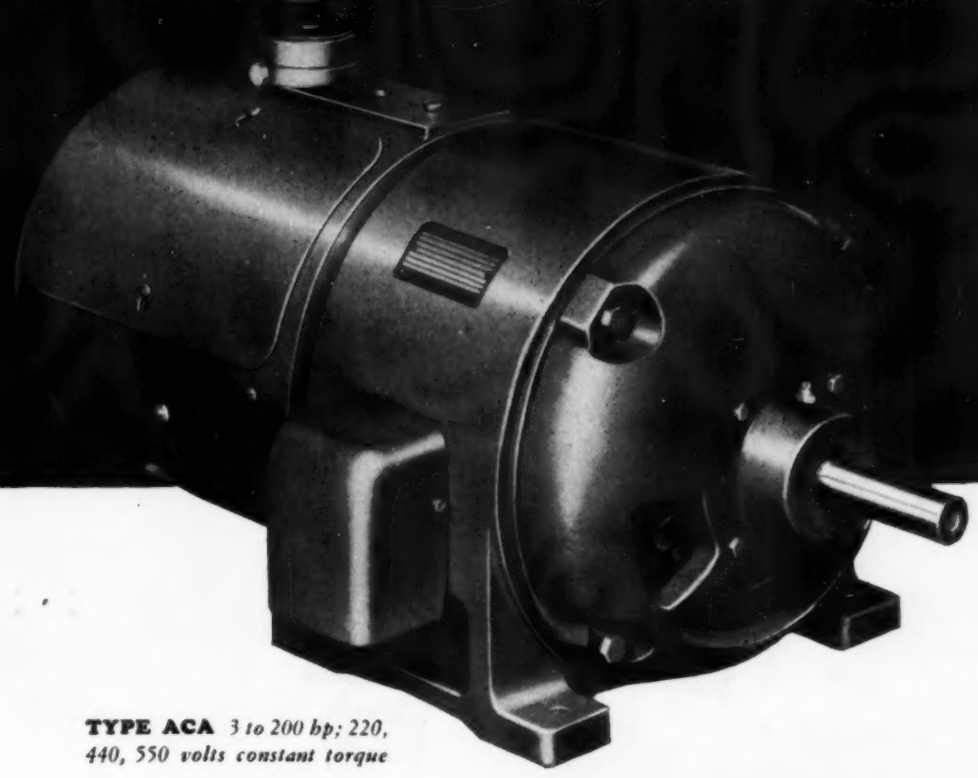
There are few limitations on your choice of location for this Tri-Clad motor, at the present offered in dripproof construction. Famous Tri-Clad construction gives it a sturdy frame for *extra protection* against physical damage; improved winding insulation for *extra protection* against electrical breakdown; and rigid bearing mountings with easy-to-lubricate bearings for *extra protection* against operating wear-and-tear. For remote control, a flexible cable or pilot motor is available. For more information, write today for Bulletin GEA-4883. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

THE NEW TRI-CLAD A-C MOTOR

REG U.S. PAT. OFF.

with 3 to 1 speed range



TYPE ACA *3 to 200 hp; 220, 440, 550 volts constant torque*

HERE'S WHERE TO USE IT!

Textile
- Slashers
- Knitting machines
- Individual finishing machines
- Spinning frames
- Weaving machines
- Printing machines

Chemical
- Shakers
- Grinders
- Pulverizers
- Mixers
- Liquid pumps
- Solids pumps

Food
- Ovens, dryers
- Mixing machines
- Labeling machines
- Grinders
- Centrifugal machines
- Conveyors
- Shaker Screens
- Pumps

Printing
- Job presses
- Coating machines
- Trimming machines
- Stitching machines
- Rotary web presses

Paper
- Winding machines
- Slitters
- Supercalenders
- Coating machines
- Waxing machines
- Embossers
- Other converting machinery
- Stock preparation machinery
- Conveyors

Metal-Working
- Drawbenches
- Lathes
- Stamping presses
- Milling machines
- Grinders

Mining
- Mill feeder drives
- Crusher feeder drives
- Sinter conveyors
- Other conveyors

GENERAL ELECTRIC COMPANY, Section B750-293
Apparatus Department, Schenectady 5, N. Y.

Please send me Bulletin GEA-4883 which describes the new Tri-Clad Type ACA motor:

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

You can't beat Tri-Clad Extra Protection!

A BUYING GUIDE FOR ABRASIVES

ABRASIVE PROBLEM:

Is there anything NEW on Identifying, Specifying and Packaging Coated Abrasives?

ANSWER BY

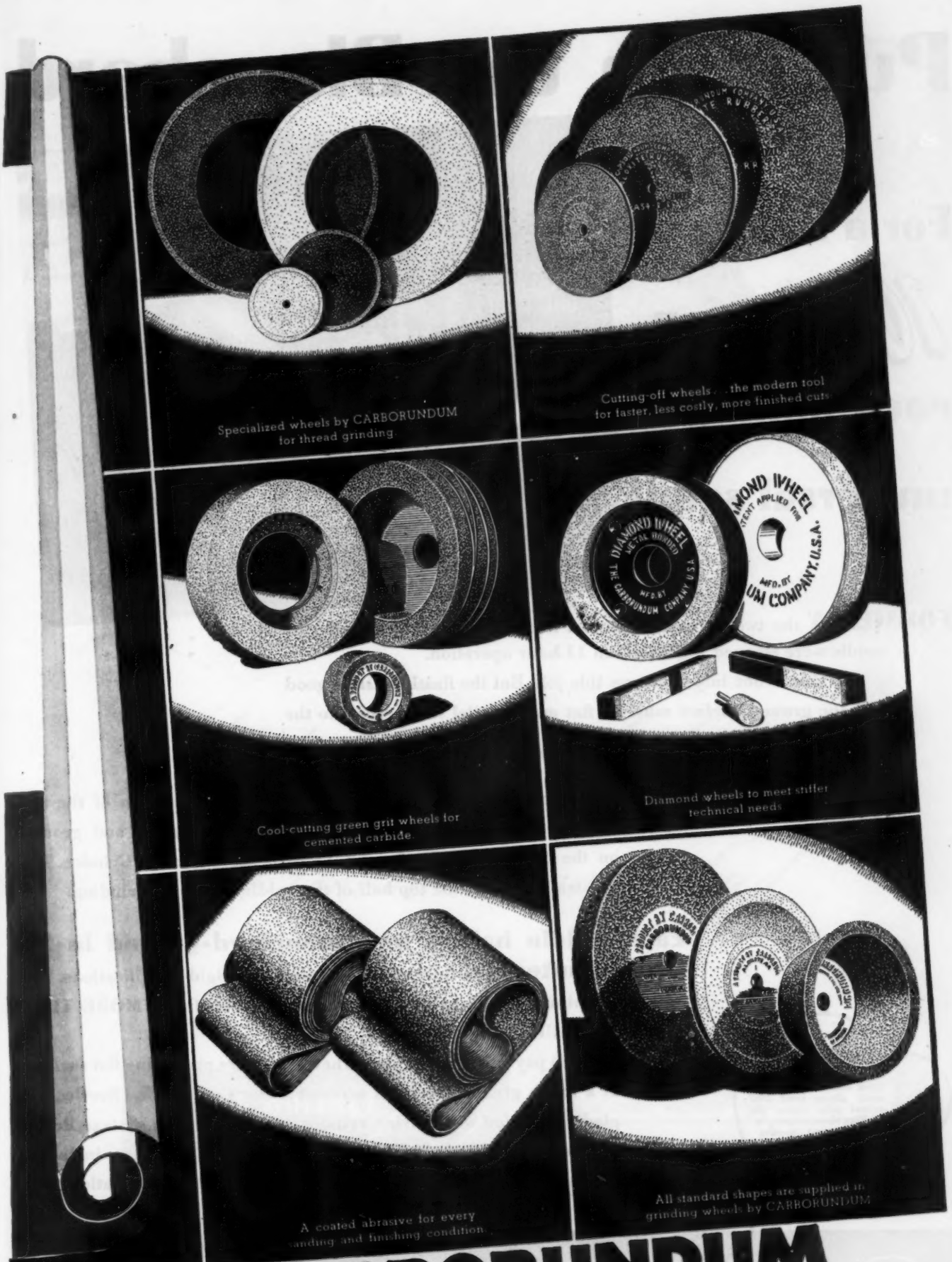
CARBORUNDUM
TRADE MARK

The Carborundum Company has developed an entirely new and more convenient method of packaging coated abrasives. Based on a careful analysis of requirements and problems of both users and distributors, it facilitates use, handling, shipping and stocking of coated abrasives.

Under this new system, sturdy packages contain "decimal" quantities of 25, 50 or 100 sheets. Cartons replace paper wrappings. Standard units are emphasized. Products are clearly identified by their end-use name on labels and backing. Ordering is expedited. Pricing and inventory are simplified. Handling is easier. Cardboard sleeves protect against curling and tearing.

This interest in the problems of our customers is amply repaid in the increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding

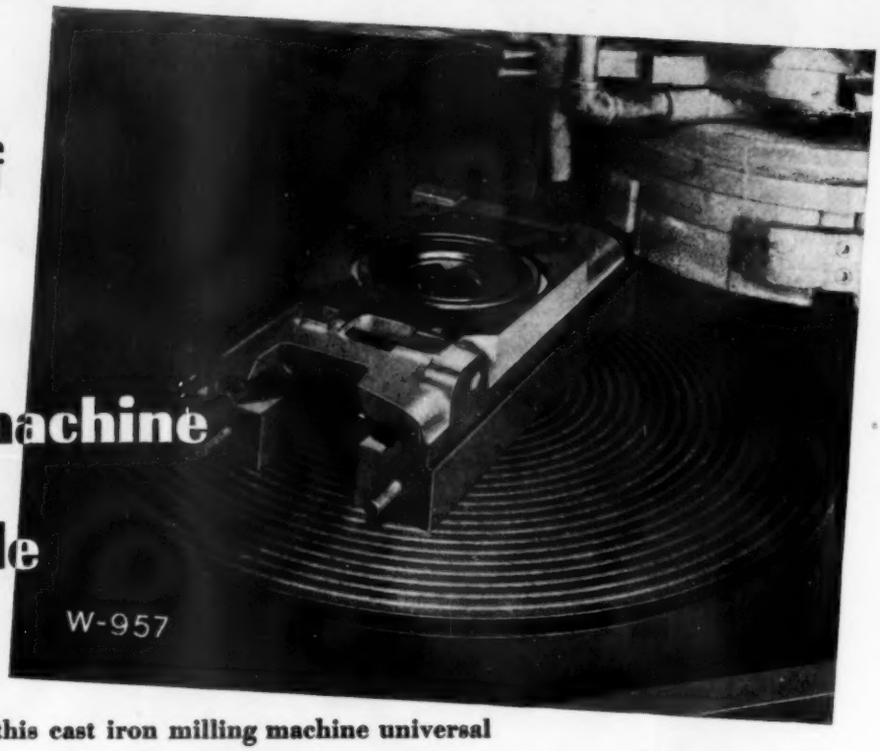

Specialized wheels by CARBORUNDUM for thread grinding
Cutting-off wheels . . . the modern tool for faster, less costly, more finished cuts
Cool-cutting green grit wheels for cemented carbide
DIAMOND WHEEL
METAL BONDED
MFD. BY THE CARBORUNDUM COMPANY U.S.A.
Diamond wheels to meet stiffer technical needs
A coated abrasive for every sanding and finishing condition
All standard shapes are supplied in grinding wheels by CARBORUNDUM

. . . CALL IN **CARBORUNDUM** TRADE MARK

● BONDED ABRASIVES ● COATED ABRASIVES ● ABRASIVE GRAINS AND COMPOUNDS

Put it on the Blanchard

For a saving of *10* hours on each milling machine universal saddle



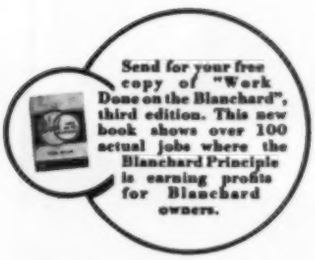
FORMERLY the two halves of this cast iron milling machine universal saddle were scraped together—an 11-hour operation.

The size is not important on this job. But the finish *must* be good and the ground surface *must* be flat and parallel with respect to the ways, within .0003 inch.

now: To eliminate the laborious and costly scraping-in of the two halves of the saddle, each half is now set on parallels and ground on the 36-inch chuck of a No. 18 Blanchard Surface Grinder. The illustration shows the top half of the saddle set up for grinding.

Each saddle half is now Blanchard-ground in 25 minutes — to fully and easily meet the rigid specifications. The 50-minute total for this job represents a SAVING OF MORE THAN *10* HOURS per saddle.

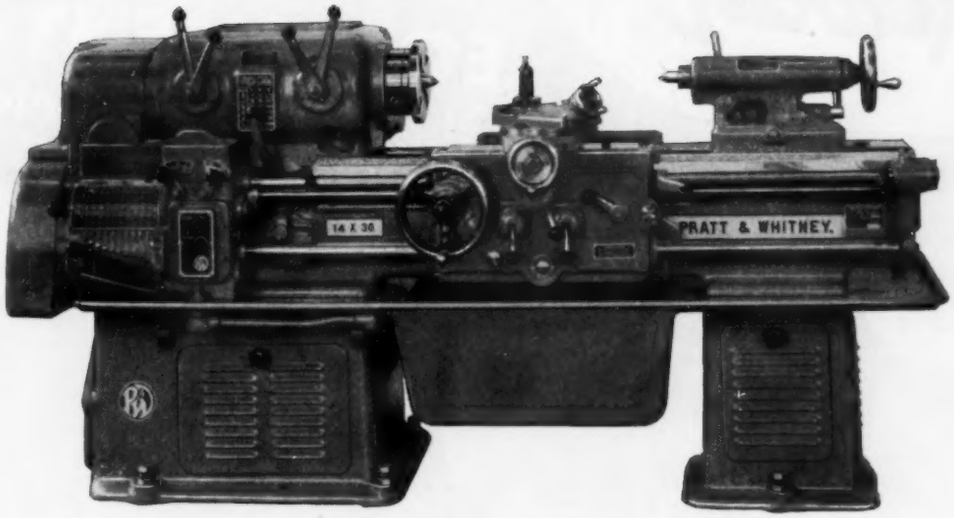
It will pay you to investigate whether you are producing flat surfaces at a much greater cost than necessary. Our Consultation Service will gladly help you with advice, reliable production data, fixture design if necessary and sample grinding. Simply send us the data—including prints and, if practicable, samples. You will incur no obligation.


Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The **BLANCHARD** MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



The standard by which all fine lathes are judged

PRATT & WHITNEY MODEL "C" Lathe

LITERATURE DESCRIBES ALL SIZES AND ATTACHMENTS

PRATT & WHITNEY • Division Niles-Bement-Pond Co.
WEST HARTFORD 1, CONNECTICUT

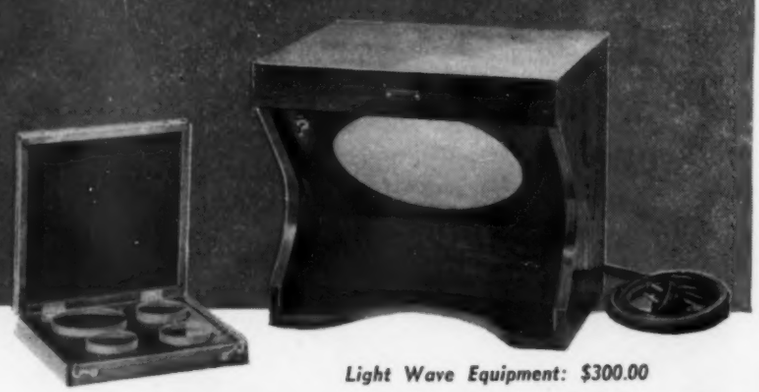
Van Keuren

LIGHT WAVE EQUIPMENTS are the proof of Precision

Detecting worn spot on amplifying gage anvil.

Checking flatness of lapped shoulder on a shaft with a special 3" diameter x 29/32" hole Fused Quartz Optical Flat.

Checking the flatness and parallelism of a micrometer anvil and spindle with a 1¼" diameter Van Keuren Fused Quartz Optical Parallel.



Light Wave Equipment: $300.00

Twenty-eight years ago, when the Van Keuren Light Wave Equipment was introduced to American Industry, measurements in Millionths of an inch seemed visionary and unnecessary. Today's and tomorrow's production requirements are specified in Micro-inches (millionths of an inch) and the ability to measure in these units is no longer visionary but a *must*.

The Van Keuren Light Wave Equipment includes a set of 4 self-checking double surface FUSED QUARTZ optical flats and an improved, instant starting 60 cycle 110 volt, minimum heat monochromatic light (light of one wave length or color).

Fused Quartz is highly transparent. It is extremely hard and has exceptional wearing qualities. It is free from strain and will not change its shape with time. Its expansion and contraction due to temperature change is less than that of any other known material. It is an ideal material for optical flats.

Insist on having Van Keuren optical flats. They are beautifully finished and are of superlative accuracy on both sides. They are the best buy.

Every plant that uses amplifying gages, measuring machines or gage blocks should have a Van Keuren Light Wave Equipment for the maintenance of these expensive tools. The equipment will instantly detect worn spots and grooves in anvils and measuring contacts, which if are not known will lead to false results. The equipment will check the flatness, parallelism and make size comparisons of gage blocks in one operation, and with elimination of temperature errors. Full instructions showing practical applications are supplied with each equipment.

The New 1948 Catalog and Handbook No. 34 is a 208-page volume, which has been in preparation for nearly two years. It contains new and epoch-making formulas and tables for the exact measurement of screws, and worms and a new method of inspecting pump seal rings for flatness with optical flats. Write today for your copy.

THE Van Keuren CO., 176 WALTHAM STREET, WATERTOWN, MASS.

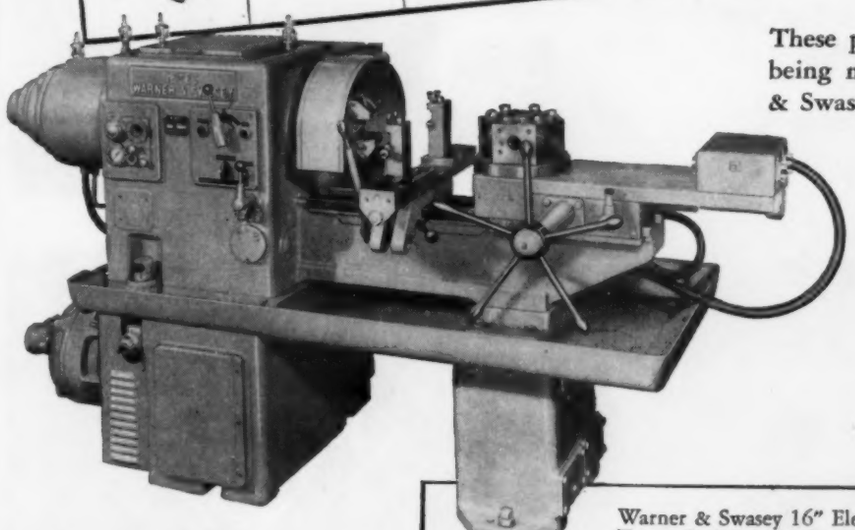
29th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Sheet Triangles • Carbolay Plug Gages • Carbolay Measuring Wires

74.9% AVERAGE PRODUCTION INCREASE WITH WARNER & SWASEY ELECTRO-CYCLES!

PRODUCTION RECORD

PART	PART NAME	OPERATIONS	PRODUCTION INCREASE
	¾" Clamp Socket	Turn, Face, Counterbore, Chamfer, Thread	136.4%
		Face, Round, Turn	226.3%
	Tap Body	Drill (2), Face (2), Tap (1), Chamfer (2)	47.5%
		Drill, Turn, Thread	45.9%
	¼" Air Cock Body	Turn, Drill, Thread, Chamfer	26.6%
	Bottom Flange	Drill, Turn, Face, Neck, Thread, Chamfer	37.0%
	Air Distributor Body	Drill, Tap, Chamfer	59.7%
	Water Faucet Body	Drill, Neck, Recess Tap, Thread, Chamfer, Seat	49.4%
		Drill, Form, Face	45.4%
		Drill, Face, Form Tap, Chamfer	50.9%
	Air Regulator Body	Drill, Recess, Turn, Face, Thread	86.2%
		Drill, Tap	26.6%
	Solid Tap Nut	Counterbore, Tap	70.3%
	Tap Bottom Body	Drill, Face, Counterbore, Tap	28.0%



These parts are typical of the many jobs now being machined in one brass shop on Warner & Swasey Electro-Cycle Turret Lathes.

Ranging from 2 to 6 operations and in lots of 100 to 10,000, a substantial profit was realized when each part was machined on faster, easier operating Electro-Cycles. The chart gives the results.

Hadn't you better find out—and quickly—what these new Electro-Cycles can do for you?

Warner & Swasey 16" Electro-Cycle Turret Lathe 1½" Bar Capacity; 16⅞" Chucking Swing.

By presetting the Electro-Cycle "drum control", spindle speed, starts and stops, spindle direction, and reverses for each turret face are automatically controlled. Operator zips through precision operations, without tiring himself on time-consuming manual operations.

You can machine it better, faster, for less...with a Warner & Swasey

WRITE—

WARNER & SWASEY Machine Tools *Cleveland*

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

ARMSTRONG

Drop Forged

EYE BOLTS

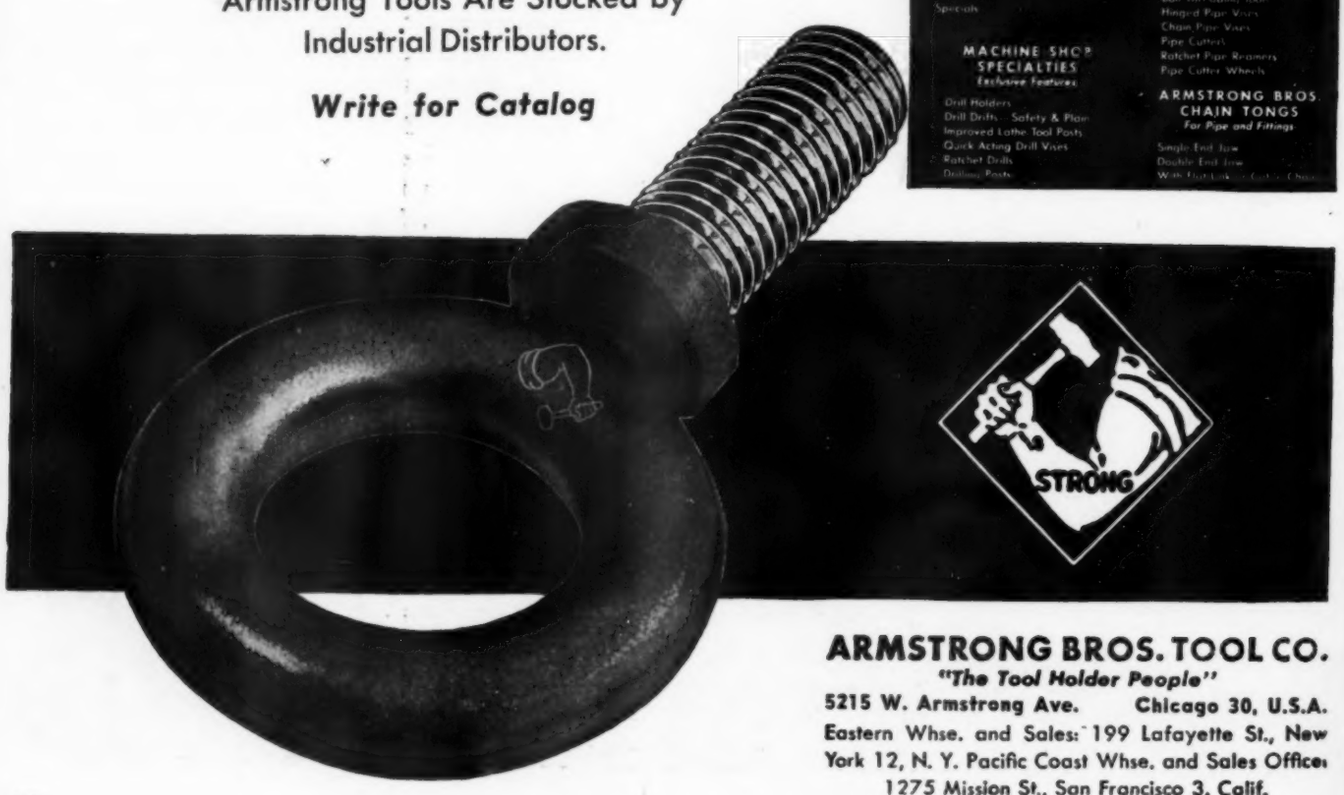
They'll carry the load

Specify ARMSTRONG Drop Forged EYE BOLTS for extra strength — correctly engineered proportions, forged-in quality, uniformity of design in all sizes, and the best mild steel, heat treated to increase tensile strength.

ARMSTRONG Drop Forged EYE BOLTS as built to tool standards, are not hammered out in "tonnage forgings". They come in plain or shoulder patterns, blank or threaded, in 14 sizes, shank diameter from ¼" to 1½", inside diameter of eye ¾" to 2½". They will always carry their rated load safely.

Armstrong Tools Are Stocked by Industrial Distributors.

Write for Catalog



ARMSTRONG BROS. TOOL CO.

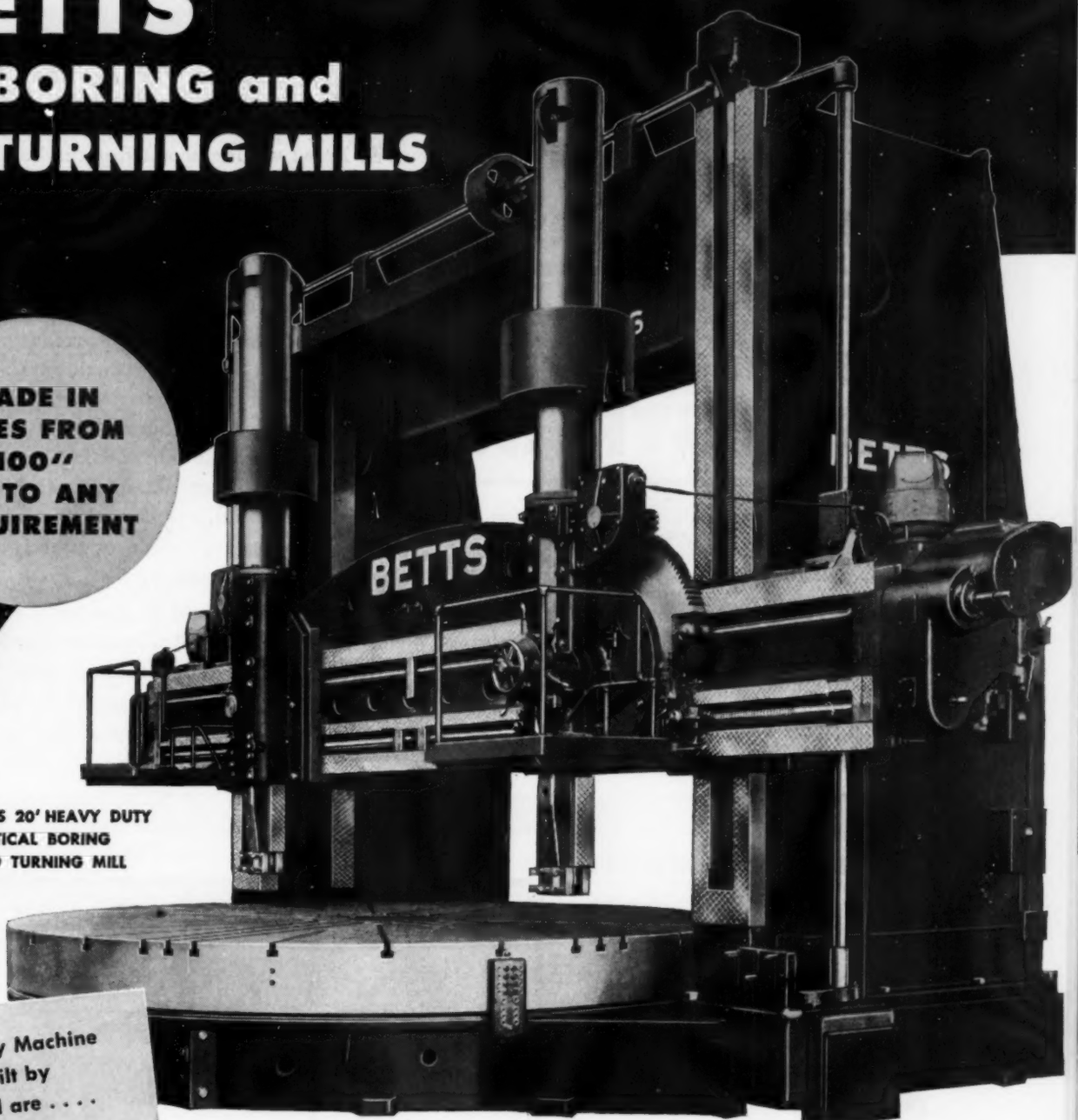
"The Tool Holder People"

5215 W. Armstrong Ave. Chicago 30, U.S.A.

Eastern Whse. and Sales: 199 Lafayette St., New York 12, N. Y. Pacific Coast Whse. and Sales Office: 1275 Mission St., San Francisco 3, Calif.

BETTS
BORING and TURNING MILLS

MADE IN SIZES FROM 100" UP TO ANY REQUIREMENT



BETTS 20' HEAVY DUTY VERTICAL BORING AND TURNING MILL

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

Betts Heavy Duty Boring and Turning Mills are general purpose tools of simple, rugged design particulary adapted to heavy continuous operations requiring a high degree of accuracy combined with power. Among the outstanding features that have made Betts Mills leaders in their field, is their type of table mounting that insures positive concentricity. They are built in a size range from 100" swing up to any size to meet your requirements.

Full information covering any size Betts Boring and Turning Mill in which you are interested will be furnished upon request.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER 10, NEW YORK

How to Get Better Milling Methods with SUNDSTRAND

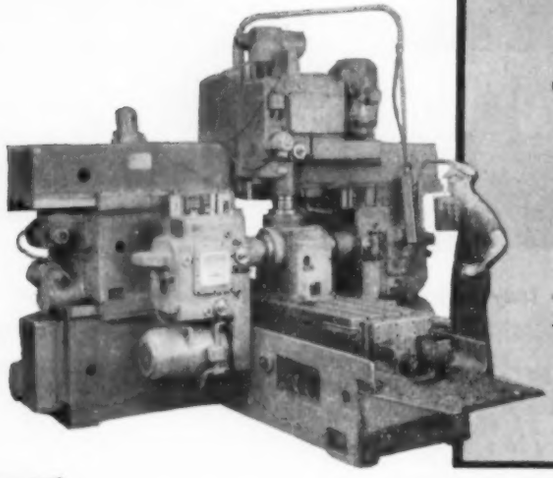
"Engineered Production"

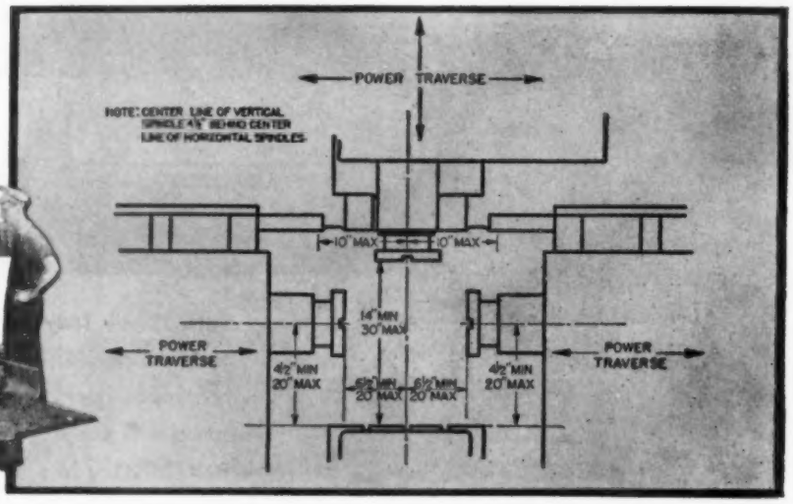
■ Better milling production can be obtained only by lowering unit production costs . . . obtaining the most economical solution to your milling problem and the most productive equipment in relation to your production requirements.

Basically, there are two approaches to solving these problems: (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method, — standard or semi-standard machines, if possible, or entirely special machines, if necessary.

This latter method is Sundstrand "Engineered Production" . . . a most practical approach to economical milling. Here's how it has been applied in three different plants on three different milling problems.

1 • Standard Rigidmils





Here's a standard Sundstrand Triplex Rigidmil with design features which add flexibility to production milling of either wide or narrow parts without sacrifice in accuracy. In this particular case, the machine is furnished with three 25 hp heads for simultaneously milling 3 sides of transfer cases, transmission cases, etc. Heads are adjustable both vertically and horizontally for handling a wide range of work. Sketch shows capacities between spindles for machine with 24" wide table. Machines can also be furnished with wider tables and greater capacity between spindles. Machine shown is provided with 14" dia. T. C. tipped cutters.

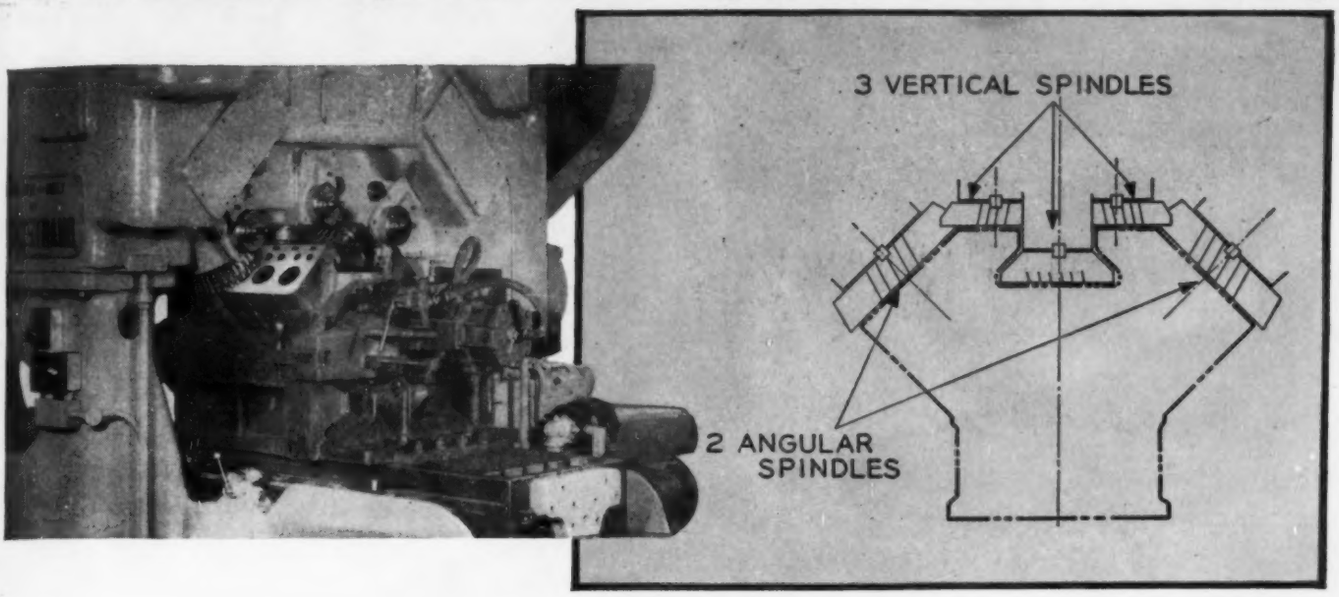
More Data FREE

This new 40 page booklet reveals how mass production milling problems can be solved most economically by one or a combination of only 3 different methods. Write for your copy today. Ask for bulletin No. 168.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

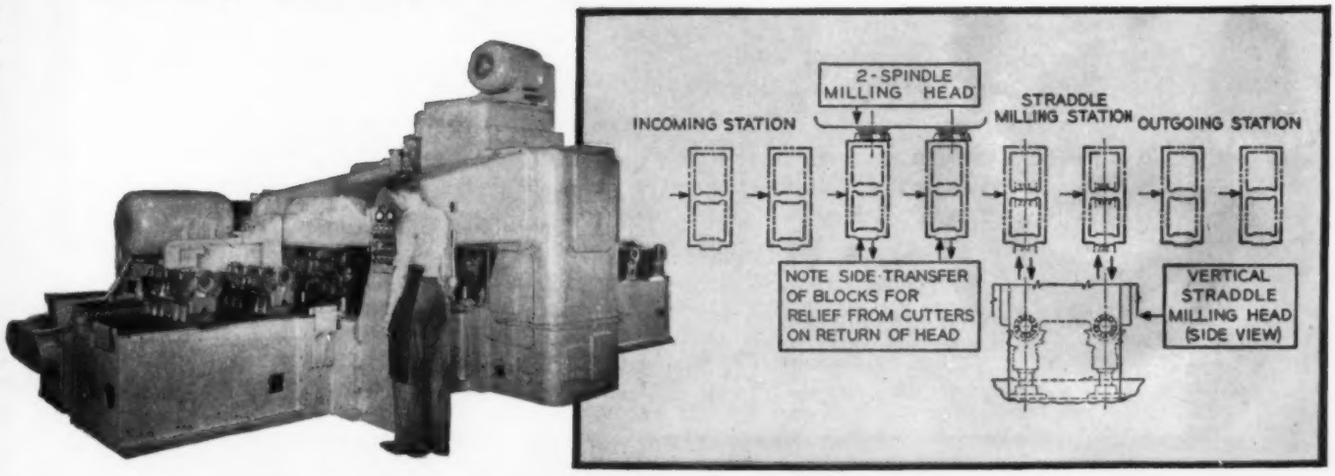
RIGIDMILS • FLUID-SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

2 • Standard Rigidmils with Special Heads and Tooling



This basically standard Sundstrand Rigidmil is equipped with a special five spindle head for milling five surfaces of a cylinder block simultaneously. Surfaces machined include the cylinder head, valve cover and manifold faces. The special head is provided with three vertical and two angular spindles carried in quills having micrometer adjustment. An air operated fixture is mounted on the table and holds the block securely while machining. The machine is provided with an automatic table cycle of rapid approach, feed, rapid return and stop.

3 • Entirely Special Machines


2-SPINDLE MILLING HEAD
INCOMING STATION
STRADDLE MILLING STATION
OUTGOING STATION
NOTE SIDE TRANSFER OF BLOCKS FOR RELIEF FROM CUTTERS ON RETURN OF HEAD
VERTICAL STRADDLE MILLING HEAD (SIDE VIEW)

This process type Sundstrand Rigidmil is designed to face mill the front end surface and straddle mill the main bearings of cylinder blocks. Four blocks are machined simultaneously and are shuttled through the machine automatically between milling operations. Operations performed as follows: two blocks move into first station and are automatically located and clamped. A two spindle horizontal head mills front ends. Clamps then release and same two blocks move to second station. After being located and clamped again the main bearings are straddle milled by a vertically fed head. Blocks are then unclamped and shuttled out of machine at a production rate of approximately 120 cylinder blocks per hour.

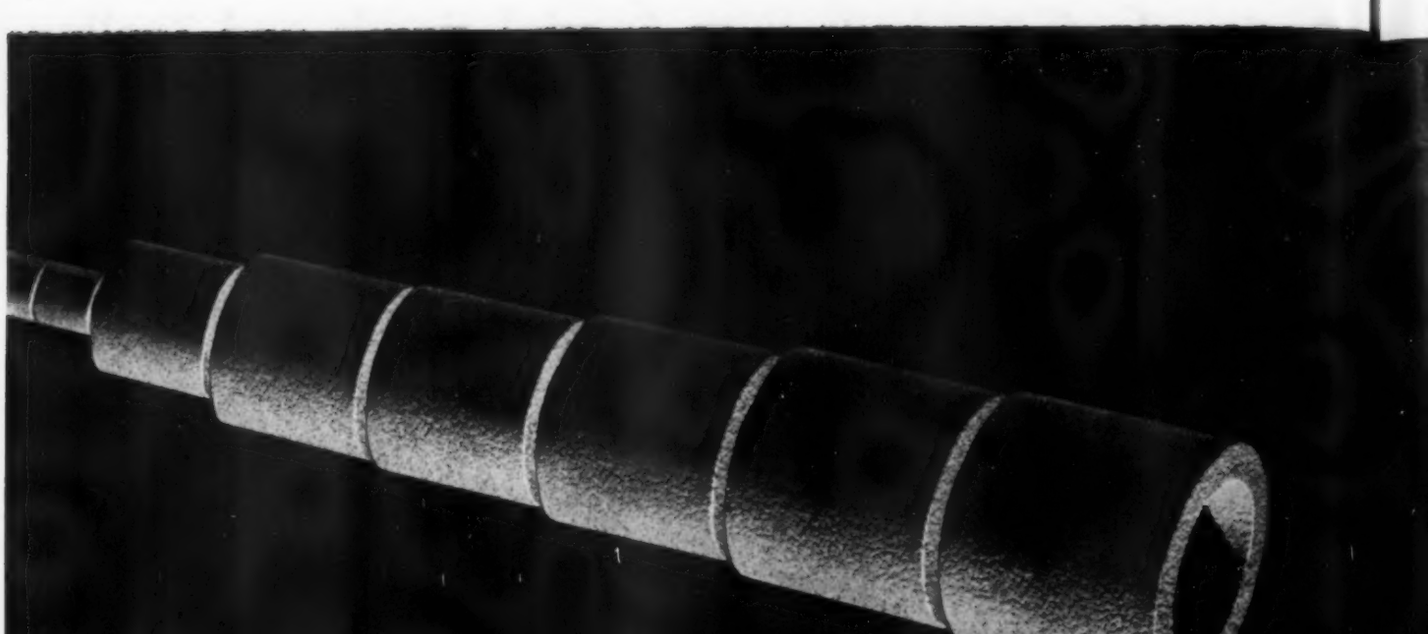
SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

SUNDSTRAND

MACHINE TOOL COMPANY

2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES



Smooth sailing for your grinding department

Switch to this leak-proof craft!

You, like so many other manufacturers, may find smooth sailing to higher profits.

To manufacturers in more than fifty diversified fields, Peninsular wheels have brought great savings in grinding costs.

Probably similar savings can be made in your grinding operations. Call in Peninsular engineers to chart a new, efficient course for you!

They will study your machines, your methods, and the materials you grind; and from these basic facts, they will develop the most economical and effective grinding wheels for your needs.

Since 1889, Peninsular has been making grinding wheels to fit specific jobs.

The Peninsular Grinding Wheel Co.,
729 Meldrum Avenue, Detroit 7.
Sales Offices: Chicago, Philadelphia, Boston, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

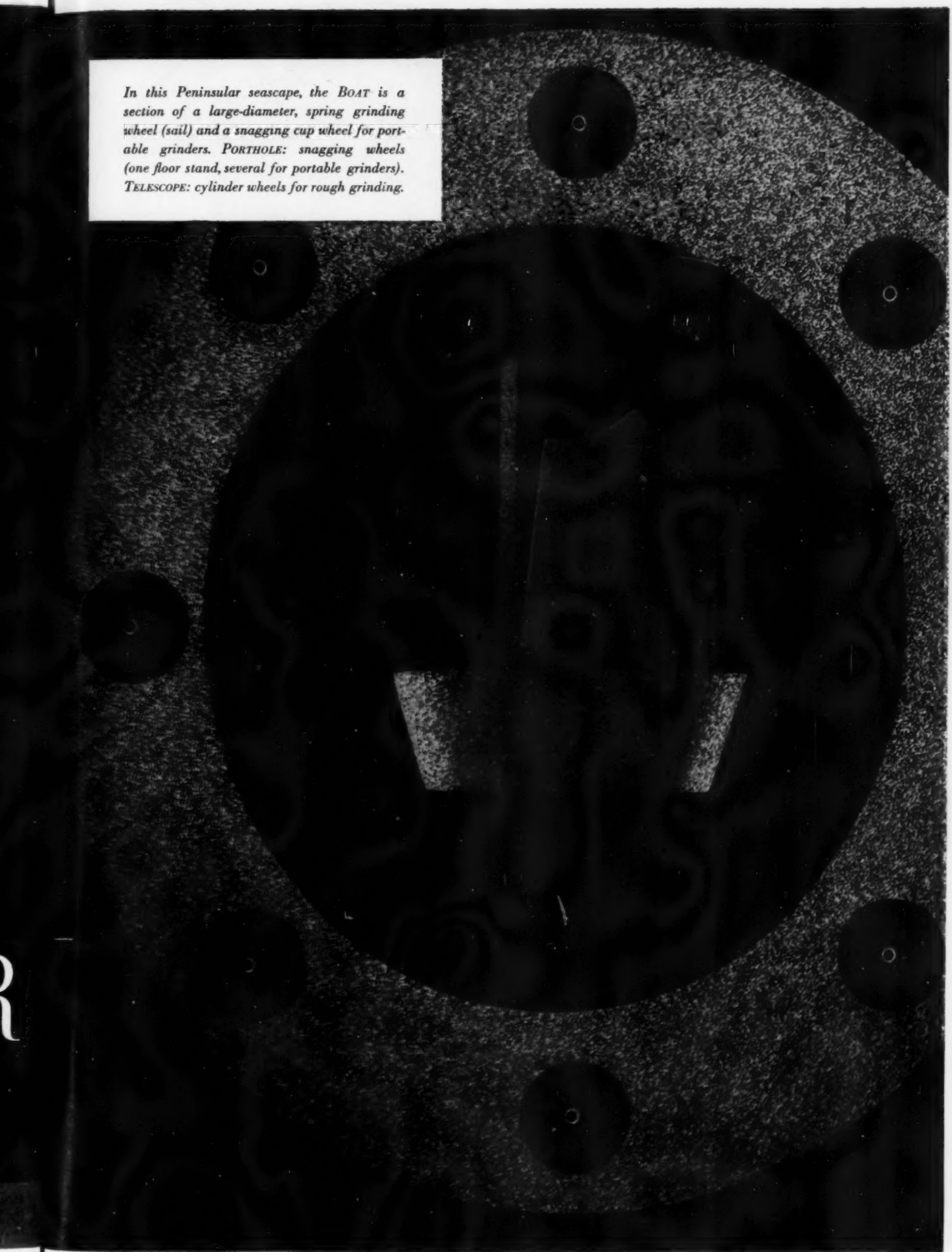
PENINSULAR

INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

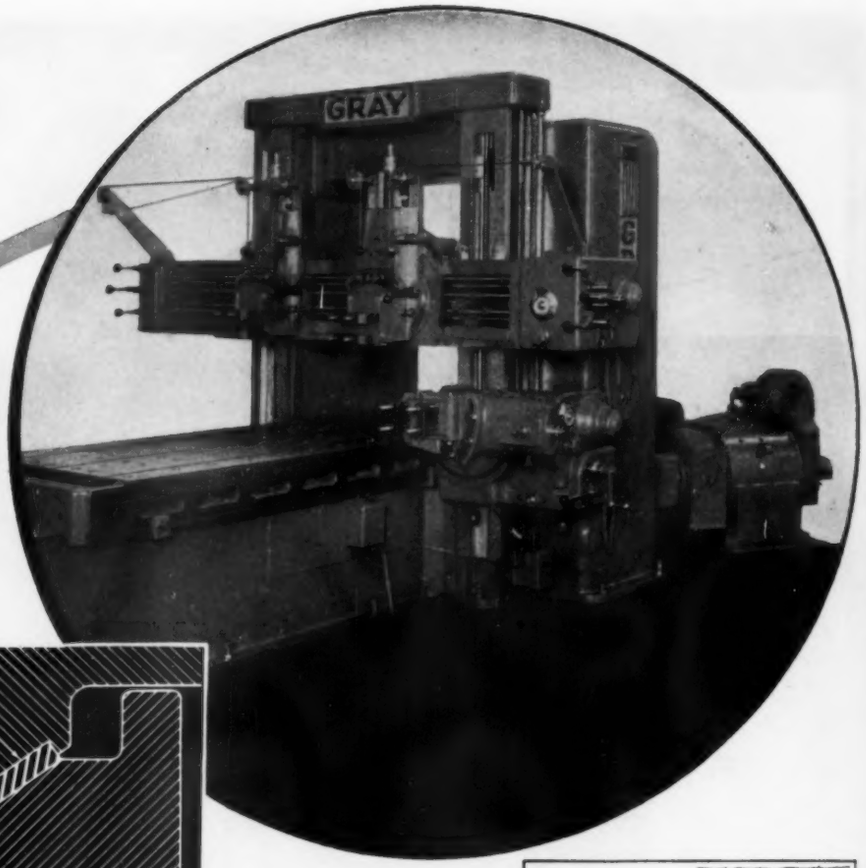
SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS

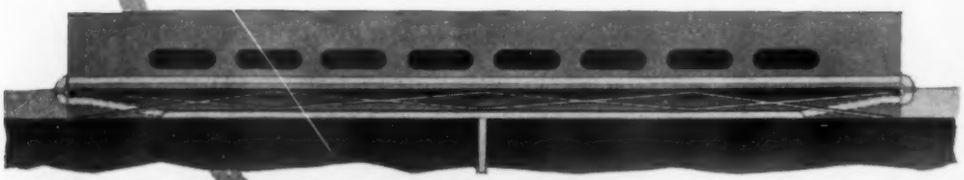


In this Peninsular seascape, the BOAT *is a section of a large-diameter, spring grinding wheel (sail) and a snagging cup wheel for portable grinders.* PORTHOLE: *snagging wheels (one floor stand, several for portable grinders).* TELESCOPE: *cylinder wheels for rough grinding.*

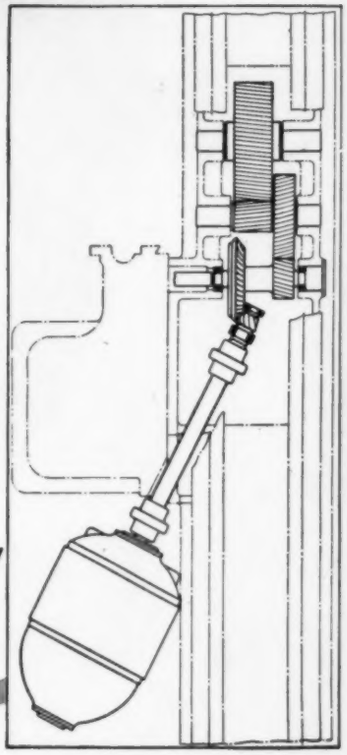
3 OUTSTANDING GRAY FEATURES



STOP SCORING *with the Gray Non-Metallic Ways*



INSURE PROPER LUBRICATION *with Gray Loop Lubrication*



SAVE SPACE *with the Gray Space Saver Drive*

The G.A. GRAY Company

CINCINNATI 7, OHIO, U. S. A.

planers • milling planers
planer type milling machines
horizontal boring machines

WINTER BROTHERS TAPS ARE DEPENDABLE

PRODUCT ENGINEERING *and* DEVELOPMENT

Winter Commercial Ground Thread Taps are typical of Winter dependability. They are form ground after hardening by an exclusive Winter process, and will work freely even on tough materials.

The design of Winter taps is based on two elements: laboratory testing and field testing. In the field, Winter taps are tested under actual production conditions. Reports of these tests are forwarded to the Winter laboratories. Here the information gained in the field is used to guide experiments in the development of better cutting tools. That is why when you specify Winter Taps you get taps which incorporate the latest advancements in metal cutting.

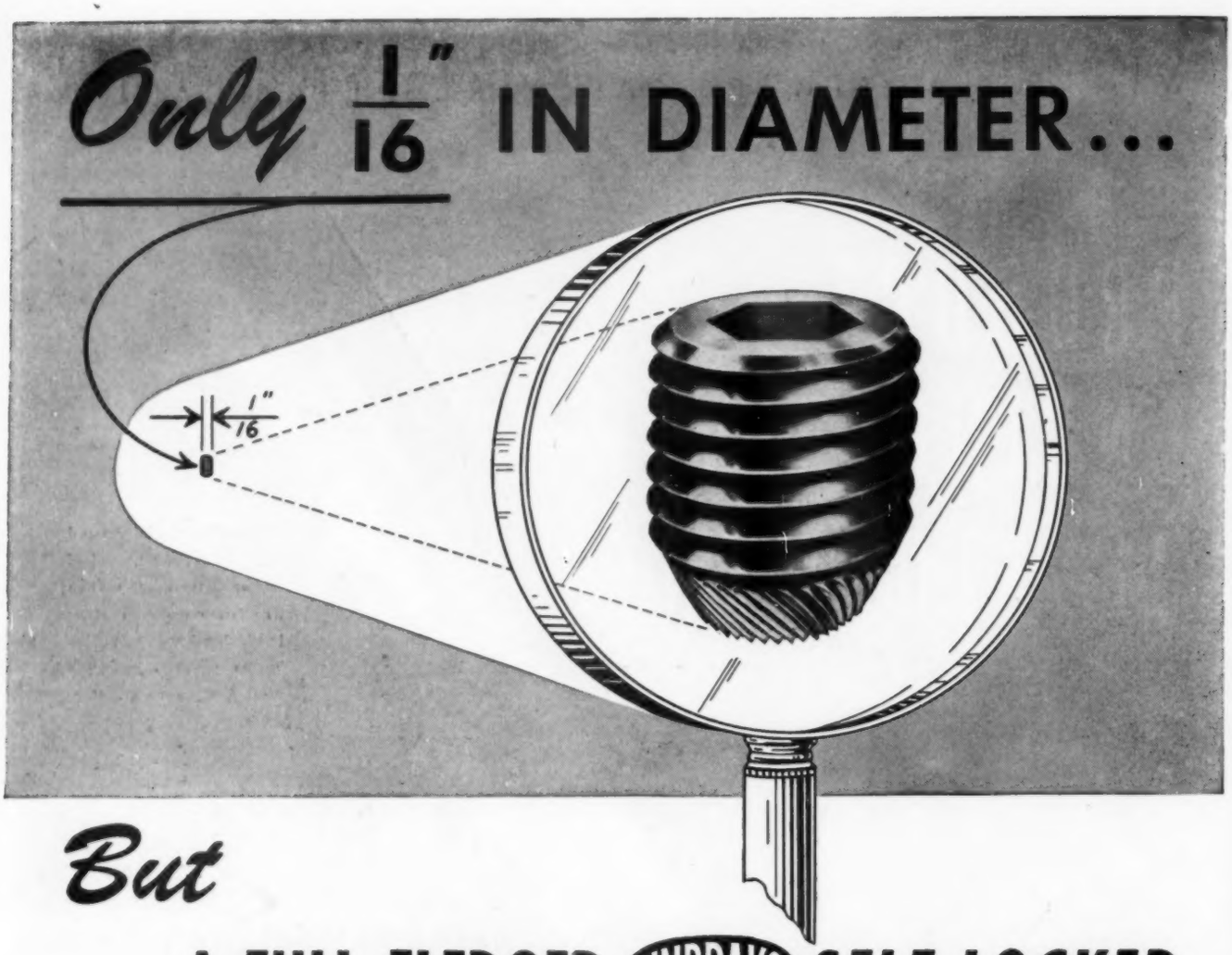
Always at Your Service

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

Winter Brothers COMPANY

ROCHESTER, MICH. and WRENTHAM, MASS. • Distributors in Principal Cities
A Division of the National Twist Drill and Tool Company • Branch Stores: San Francisco, Chicago, Detroit

Only 1/16" IN DIAMETER...



But

A FULL-FLEDGED UNBRAKO SELF-LOCKER

Reg. U. S. Pat. Off.

...KNURLED CUP POINT, HOLLOW SOCKET HEAD, AND ALL

"Unbrako" and "Hallowell" Products are sold entirely through Industrial Distributors.

Knurling of Socket Screws originated with "Unbrako" in 1934.

Yes, regardless of size, the knurled cup points of "Unbrako" Socket Set Screws dig-in and "*stay dug*" — even when subjected to the most chattering vibration. Yet, they can be easily backed-out with a wrench and used over again and again. Write for your copy of the "Unbrako" Catalog of Socket Screw Products.

The Knurled threads make this screw a Self-Locker, too, for Flat, Cone, Oval, Half and Full Dog Points.

Pat'd & Pats. Pend.

The Knurled head of this "Unbrako" provides a slip- and fumble-proof grip, though the fingers and head be ever so oily, therefore, it can be screwed-in faster and farther before it becomes necessary to use a wrench.

You can't tighten or loosen socket screws without a hex-socket wrench so why not get our No. 25 or No. 50 "Hallowell" Hollow Handle Key Kit which contains most all hex bits.

Kits: Pats. Pend.

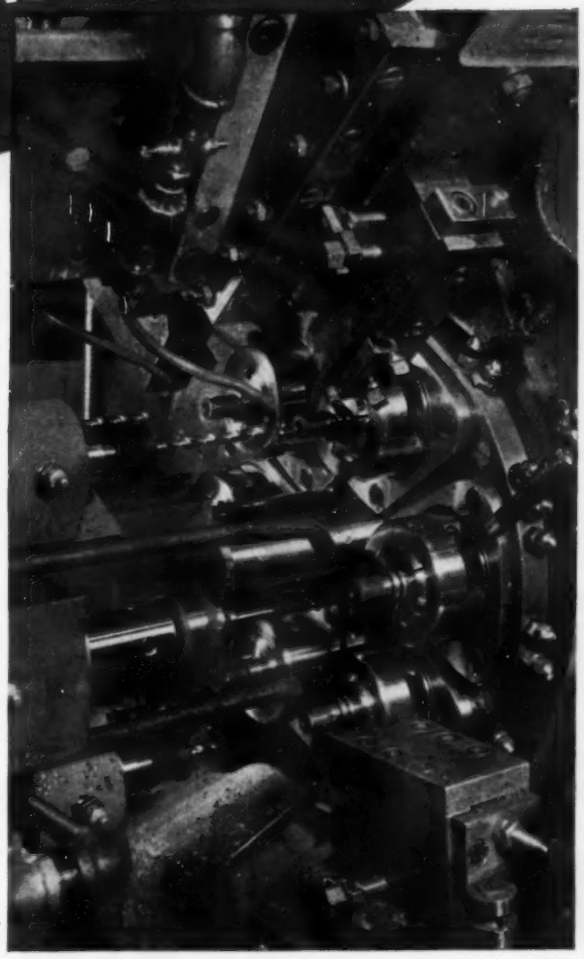
All types of patented "Unbrako" Set Screws can be made Self-Locking . . . regardless of point.

OVER 45 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

PROFITABLE PRECISION PRODUCTION WITH ACME-GRIDLEY AUTOMATICS



JOB FACTS

Bushing Valve Guide—Cast Iron

Concentricity of hole (2¼" long) and O. D. held within .002". Machine time, 4.1 seconds, or 878 pieces per hour—on Acme-Gridley 1" RA-6 Spindle Bar Automatic.

How the Job is Handled

Cast-iron parts come to the machine already rough centerless-ground. They are magazine fed through the rear of the spindle by mechanical means, and chucked on the large diameter against a stop. All six end working tool positions are utilized for tools. Air is injected through the 4th and 5th position collets, which, together with a heavy flow of light cutting oil, eliminate chip dust—insuring concentric chucking, essential to the .002" limits.

Why you'll get MORE GOOD PIECES IN THE PAN with Acme-Gridley Automatics

1. The design is stable—proved in use on more than 40,000 Acme-Gridley Multiple Spindle Automatics.

2. Rigidity and precision construction are combined in a finished machine that stands up—for exceptionally fine-tolerance work at high speeds.

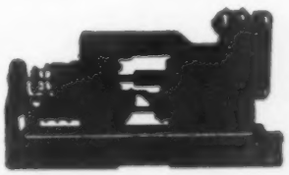
3. The design is adaptable—wide tooling zone with provisions for independent auxiliary drives places no limits on the ingenuity of tooling employed.

4. Quick change (positive) camming for both short and long run jobs insures sustained accuracy at high production rates—more good pieces in the pan.

May we show you how Acme-Gridley Automatics can increase profits and precision on your production?

THE NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

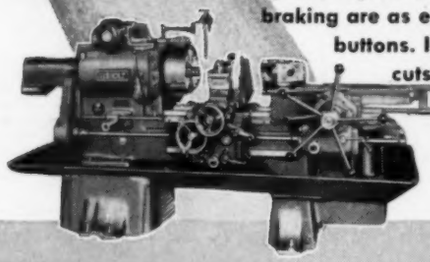


ACME-GRIDLEY BAR and CHUCKING AUTOMATICS built in 1, 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

GISHOLT TURRET LATHES

Finger-tip spindle control starts, stops, or reverses the spindle. Saves time--saves effort--saves money

It's power-operated. Clutching and braking are as easy as pressing buttons. Instant response cuts time lag, steps up production.

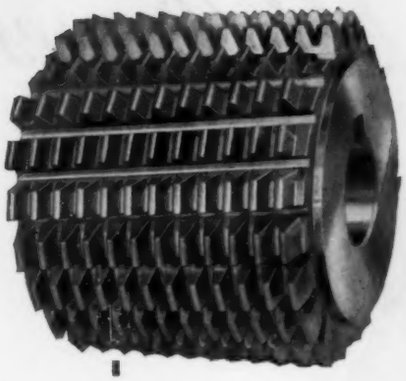


GISHOLT MACHINE COMPANY *Madison 3, Wisconsin*

The GISHOLT Round Table represents the collective experience of specialists in the machining, surface-finishing, and balancing of round and partly round parts. Your problems are welcomed here.

turret lathes · automatic lathes

FURTHER PRODUCTION *increases*



with new BARBER-COLMAN "*MULTITHREAD*" Hobs

Where machine conditions are right, and tolerances are adaptable, Barber-Colman "*Multithread*" Hobs offer further increases in gear output from your existing hobbing machines.

For example, the job illustrated below was reduced from two operations to one cut by using "*Multithreads*". The machine's capacity for these large diameter hobs brought floor-to-floor production time down to 3.1 minutes per gear.

Best results with these hobs have been obtained on semi-finished gears, although they are used in some cases for finishing. The use of these hobs depends largely upon machine conditions, the amount of stock to be left for finishing and the characteristics of the particular gears to be cut.

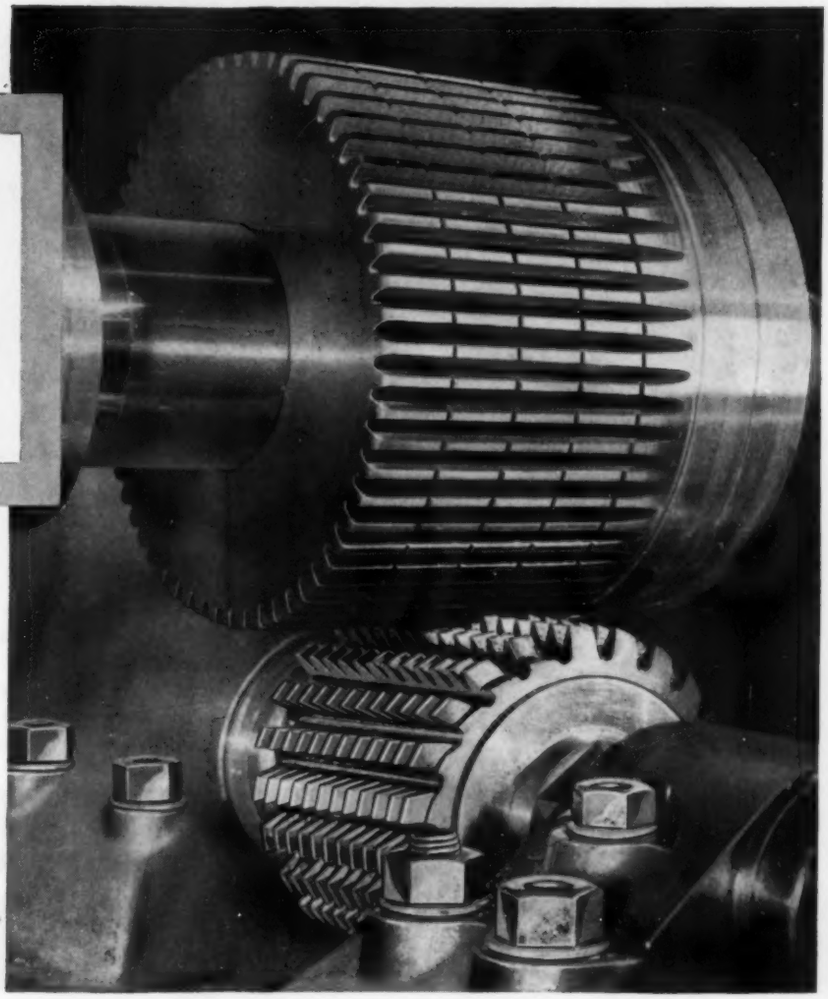
We are anxious to demonstrate what these new hobs will do, and we invite your questions and job requirements. Only on the basis of a comprehensive analysis of your job can we estimate accurately the possibilities for improvement with "*Multithreads*"

Barber-Colman Company

GENERAL OFFICES AND PLANT 181 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.

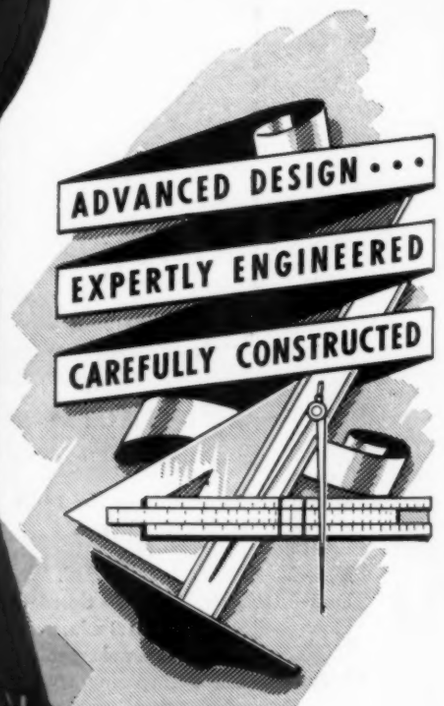
JOB FACTS

Operation — Climb Hob Precision Change Gears
Machine—Barber-Colman No. 14-15
Hob—Barber-Colman Ground "*Multithread*" Hobs
Material—NE 8949, 30-34 R.C.
Feed—.150"/rev. Speed—91 SFM
Floor-to-Floor Time—21.8 min. per load of 7
Hob Life—150 gears per sharpening
Accuracy—Adjacent spacing .0003"/.0005"



BARBER COLMAN — MODERN MACHINES DEMAND *Modern* CUTTING TOOLS

Modern CLEVELAND Two Point Presses



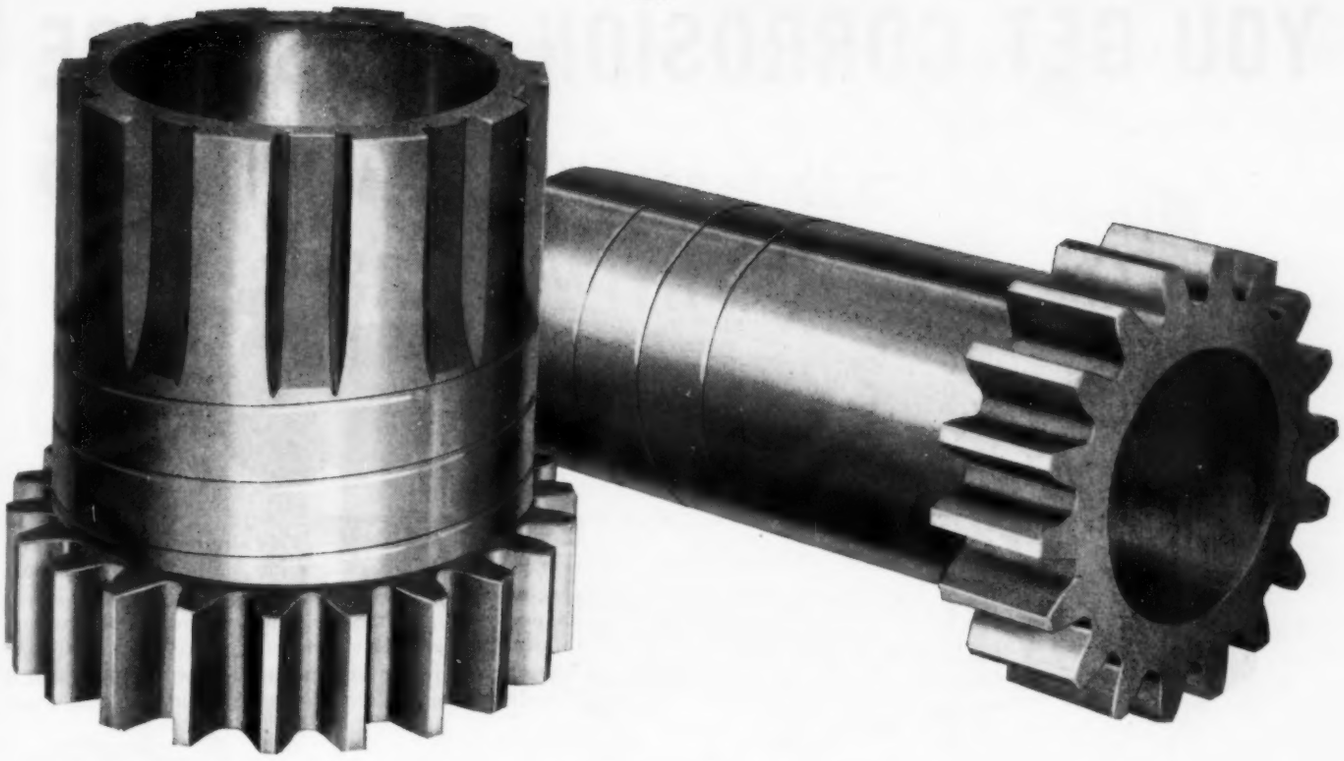
Designed to meet the most exacting requirements of modern manufacturing, and for accessibility; Modern Cleveland Presses are highly efficient, productive and economical. Their rugged, compact construction assures long life and low upkeep while the features incorporated in their design provide faster, better and more accurate production without interruption.

The Press illustrated has 20" stroke, 4" adjustment, 50"x108" bed area and a capacity of 200 tons.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

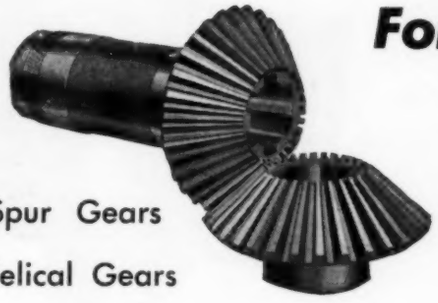
MAIN OFFICE AND WORKS • ST. CLAIR AND EAST 40TH ST. • CLEVELAND 14, OHIO



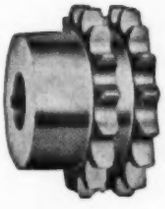
For Better Product Performance

Specify Adams

"TAILOR-MADE" GEARS



Spur Gears
Helical Gears
Splined Shafts
Worms
Worm Gears
Bevel Gears
Miter Gears
Sprockets
Ratchets
Racks
Lead and Feed Screws



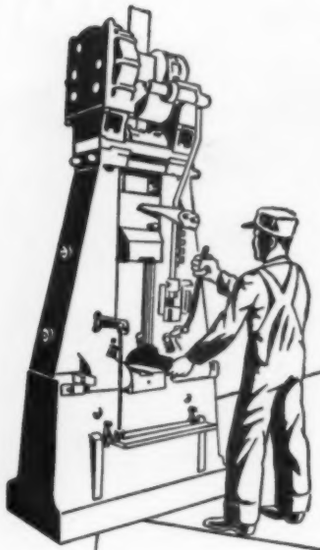
When you "specify Adams" for your gear requirements, you'll get the smooth, efficient power transmission so important in improving performance standards of your product. Each Adams gear is built to close tolerances of accuracy and uniformity, especially designed for its specific job. Sixty-five years of experience in meeting industry's requirements, the constant improvement of facilities for precision manufacture, and exacting inspection and testing on modern equipment, have made us specialists in transforming your specifications into fine gears. Write for details, or consult our engineers. THE ADAMS COMPANY, 1942 Bridge St., Dubuque, Iowa.

The ADAMS Compa
Dubuque, Iowa, U. S. A.

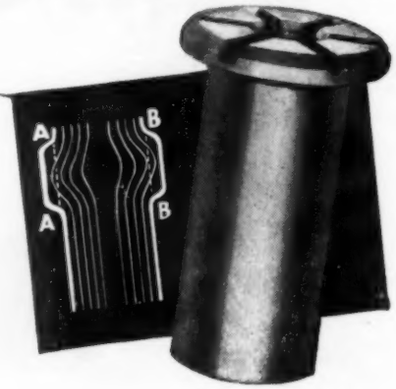
GEARS

FINE GEARS MADE TO YOUR SPECIFICATIONS . . . ESTABLISHED 1803

YOU GET CORROSION RESISTANCE PLUS



LOWER UNIT COSTS. This aircraft fuel supply valve body was forged from Carpenter *Stainless No. 8* (*Type 303*) forging bars. Our *machine-turned* billets, from which all Carpenter forging bars are rolled, provided freedom from injurious surface defects, reducing rejects to a minimum. The corrosion resistant properties of Stainless No. 8 licked the danger of "valve sticking" from high octane gas.



LONGER LIFE. In spite of tremendous pressures and highly abrasive conditions in service—forged knuckle pins like this stay on the job longer because they are made from Carpenter Stainless. And note in the diagram that forging produced an even grain flow throughout, thus strengthening the thin sections at points AA and BB.

POSITIVE PROTECTION against corrosion to withstand the effects of repeated sterilization plus the required strength and hardness, made Stainless a natural choice for these forged surgical instruments. Clean, flawless Carpenter Stainless forging bars reduced rejects, increased output.

ECONOMICAL, TROUBLE-FREE FORGINGS WITH *Carpenter* STAINLESS

If rejects run high when forging Stainless, it's time to check all along the line. Many factors must be controlled right in the forge shop. But to eliminate trouble and secure best results you must be sure that your forging bars are sound, clean and free from injurious surface defects. Such forging bars assure easiest forging operations and lowest production costs.

At Carpenter, Stainless Steels are made in a tool steel mill to tool steel quality standards. Stainless billets are disc-inspected to assure soundness and homogeneity—and are then *machine-turned* to remove all surface imperfections. By this painstaking process we end up with Stainless bars that, lot after lot, assure economical, trouble-free forgings.

You'll find your nearby Carpenter representative extremely helpful when it comes to finding ways and means of applying Stainless to your products. Back of him stands a company with years of practical experience in solving Stainless problems. Call him in today or write us at the mill.

This handy Carpenter Stainless Steel Selector Slide Chart will help you quickly spot the right grade of Stainless to meet your requirements. It provides data on working properties, physical characteristics, etc., of each grade of Stainless. A note on your company letterhead, indicating your title, will bring you a Carpenter Stainless Selector Slide Chart.

THE CARPENTER STEEL COMPANY, 109 W. Bern St., Reading, Pa.

GIVE YOUR PRODUCTS THESE EXTRA ADVANTAGES . . . With Carpenter Stainless

- **Strength and Rigidity**
- **Heat Resistance**
- **Weight Saving**
- **Freedom from Rust**
- **No Plating to Peel**
- **Ease of Assembly**
- **Longer Product Life**
- **Sales Appeal**

Carpenter

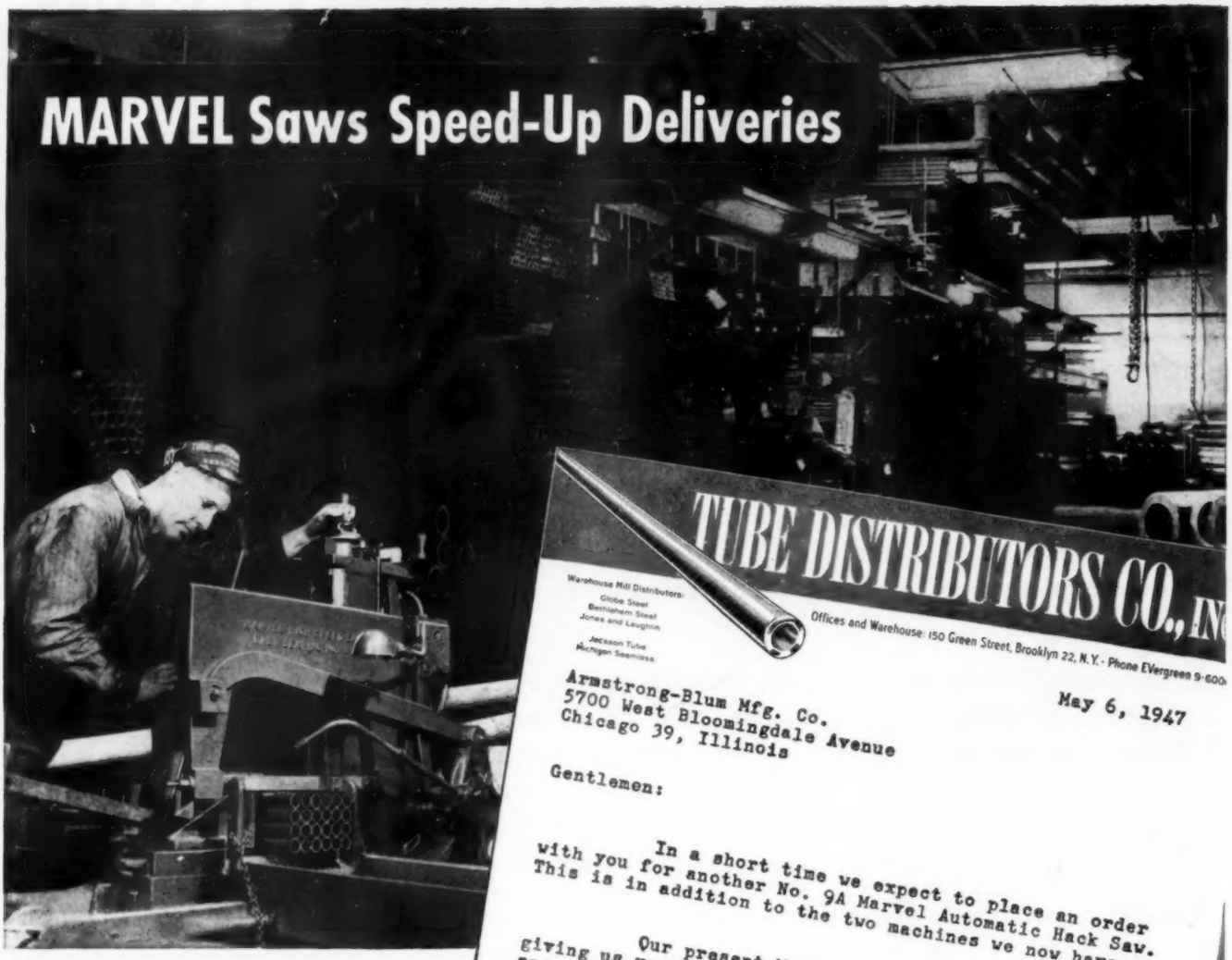
STAINLESS STEELS

Call your local Carpenter warehouse

Boston • Bridgeport, Conn. • Buffalo • Chicago • Cincinnati • Cleveland • Dayton
Detroit • Hartford • Indianapolis • Los Angeles • New York • Philadelphia
Providence • St. Louis • Worcester, Mass.

SEE THE CLASSIFIED SECTION OF YOUR TELEPHONE DIRECTORY

MARVEL Saws Speed-Up Deliveries



TUBE DISTRIBUTORS CO., IN

Warehouse Mill Distributors:
Globe Steel
Bethlehem Steel
Jones and Laughlin
Jessop Tube
Michigan Seamless

Offices and Warehouse: 150 Green Street, Brooklyn 22, N.Y. - Phone EVergreen 9-600

May 6, 1947

Armstrong-Blum Mfg. Co.
5700 West Bloomingdale Avenue
Chicago 39, Illinois

Gentlemen:

In a short time we expect to place an order with you for another No. 9A Marvel Automatic Hack Saw. This is in addition to the two machines we now have.

Our present Marvel Automatic Hack Saws are giving us very satisfactory service, enabling us to speed cutting of mechanical and boiler tubes to our customers' required lengths at a minimum of cost, both for labor and blades.

Your service and attention to our requirements have been very satisfactory.

Sincerely,

TUBE DISTRIBUTORS CO., INC.

A. F. Lewis

AFL:CB

Superintendent

Steel warehouses and stockrooms deliver cut-off lengths in any quantity FASTER—BETTER—CHEAPER when equipped with MARVEL 6A and 9A Automatic Hack Saws. Far faster, floor to floor, than any other hack saws, they save valuable machine hours by reducing cutting-off time to a fraction—save other machining hours by producing accurately cut pieces of exact length.

There is a MARVEL Saw for every need—in every capacity range and price class. Your local MARVEL Sawing Engineer will gladly study your metal sawing problems and requirements and make recommendations as to methods and equipment.

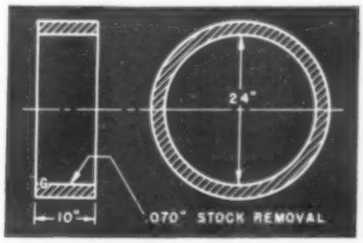
Metal Cutting
MARVEL SAWS
Better Machines-Better Blades

ARMSTRONG-BLUM MFG. COMPANY
"The Hack Saw People"
5700 BLOOMINGDALE AVENUE CHICAGO 39, U. S. A.

What's in
VERMONT
this month?

ONE BRYANT INTERNAL GRINDER SAVES 14,560 HOURS IN ONE YEAR. A steel ring with a 24-inch I.D. and 10-inch length required 700 minutes floor to floor for finishing. Stock removal was about .070 inch. A new Bryant No. 150 with a five foot face plate was put on the job and finished the same pieces in 35 minutes, floor to floor.

One department estimated 16,640 hours grinding time for the coming year. On the basis of the above performance, this department's revised figure shows 2,080 hours grinding time to do the same amount of work, or a saving of 14,560 hours. This demonstrates clearly how important it is to check estimated production time on new available machines against the production time of the machines on your floor.



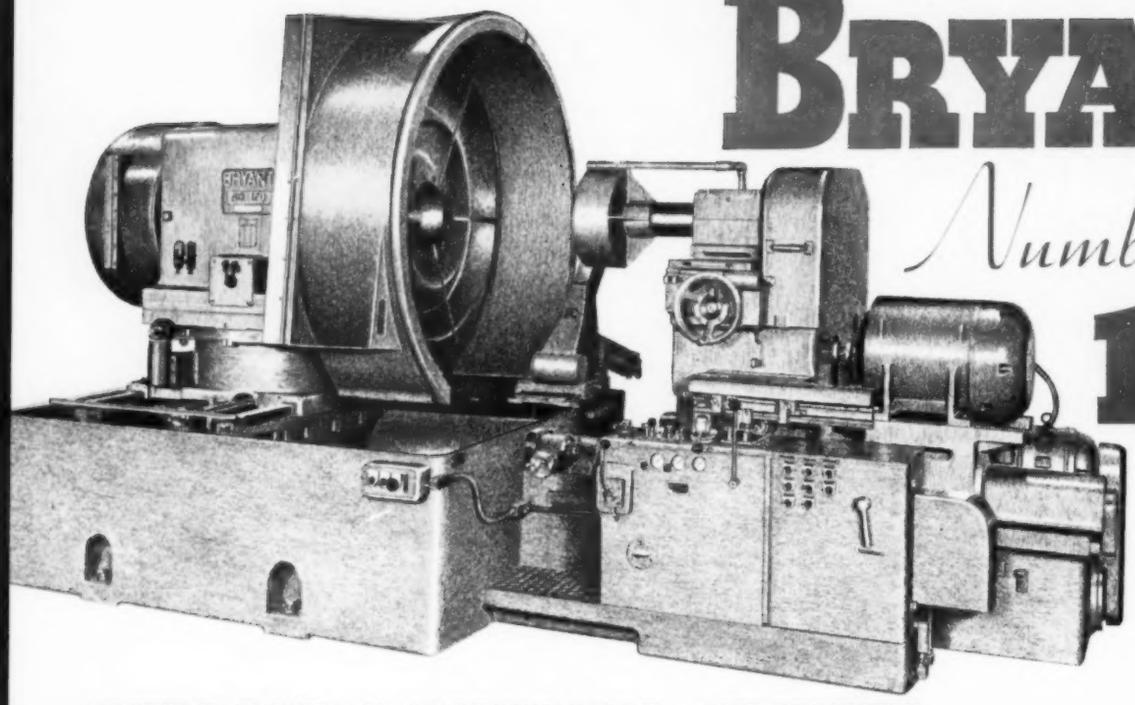
It won't cost to inquire.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

BRYANT

Number

150



HYDRAULIC INTERNAL GRINDER

The No. 150 with 60-inch maximum swing is the largest internal grinder in the Bryant line. Other Bryant equipment will grind holes through the complete range down to holes as small as ⅛-inch in diameter. Write to the factory for full information.

SPECIFICATIONS

Total swing	60 inches
Maximum traverse	21 inches
Maximum hole depth	16 inches
Will grind included angle 60°	
R.P.M. of work spindle — 15, 25, 35, and 50 R.P.M.	
Net weight	12 tons
Floor space — 14 feet x 9 feet (with coolant tank)	

SLIDES
Bryant cylindrical steel slide.

WORKHEAD
Anti-friction bearings. 60-inch face plate. 9-inch through hole. 30-inch cross and 20-inch axial adjustment.

WHEELHEAD
Interchangeable quill type, belt driven, anti-friction bearings.

TRAVERSE
Infinitely variable, hydraulically powered.

CROSS FEED
Variable speed, hydraulically operated feedscrew.

BRYANT PORTABLE INTERNAL THREAD GAGE. A fast, accurate, visual way to check threaded parts while still chucked in the machine. Also ideal for inspecting threads in large castings and pieces too heavy to move to the inspection department. Capacity of two models — $\frac{7}{16}$" to 1" and 1" to 3". Write for details.

You can *"See the Difference"* with a BRYANT GAGE

It is no longer necessary to "feel for fit" with plug and ring gages when inspecting threads. The Bryant Thread Gage shows, on a dial indicator, whether a thread will assemble properly with its component.

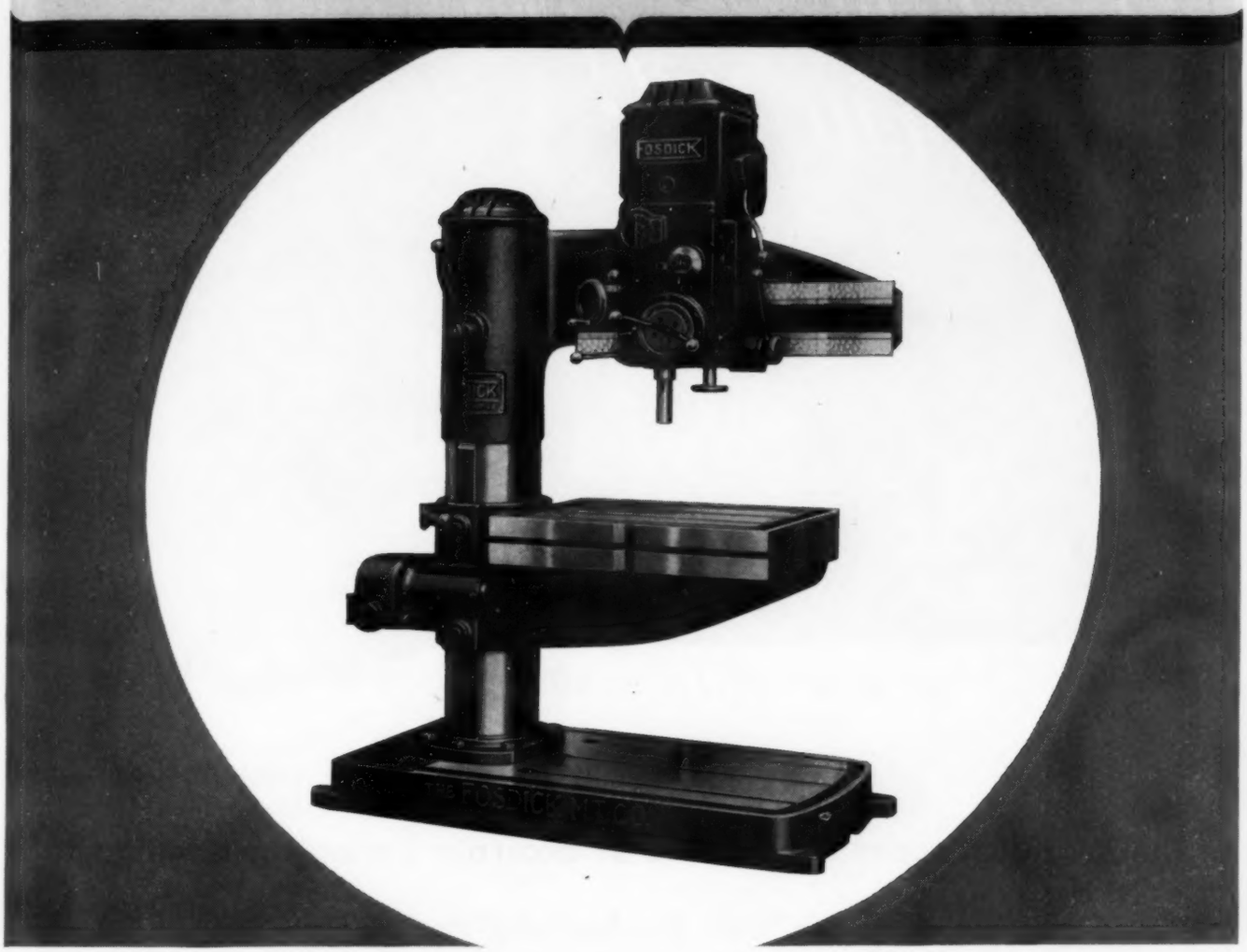
At a glance, anyone can compare threaded parts with a master and tell the whole story immediately — size, presence of burrs, out-of-roundness, accumulated inaccuracies of pitch, lead, diameter and thread form.

It's fast too. The design incorporates three thread segments, two stationary and one movable. The segments are operated by a thumb lever — the part is dropped between the segments — the lever is released, causing immediate contact of segments to threads — a one third turn of the part inspects it all over.

Send samples or drawings for a complete story on how Bryant can save inspection money for you.

Bryant Chucking Grinder Co., Springfield, Vermont, U.S.A.

FOSDICK *Sensitive* RADIAL



A departure from conventional radial design

● This new Fosdick Sensitive Radial fills a distinct need in the sensitive drilling field. It departs from the conventional radial design in that the arm is at a fixed height and an adjustable table is fitted to the column. Both the arm and table can be swung in a 360° arc.

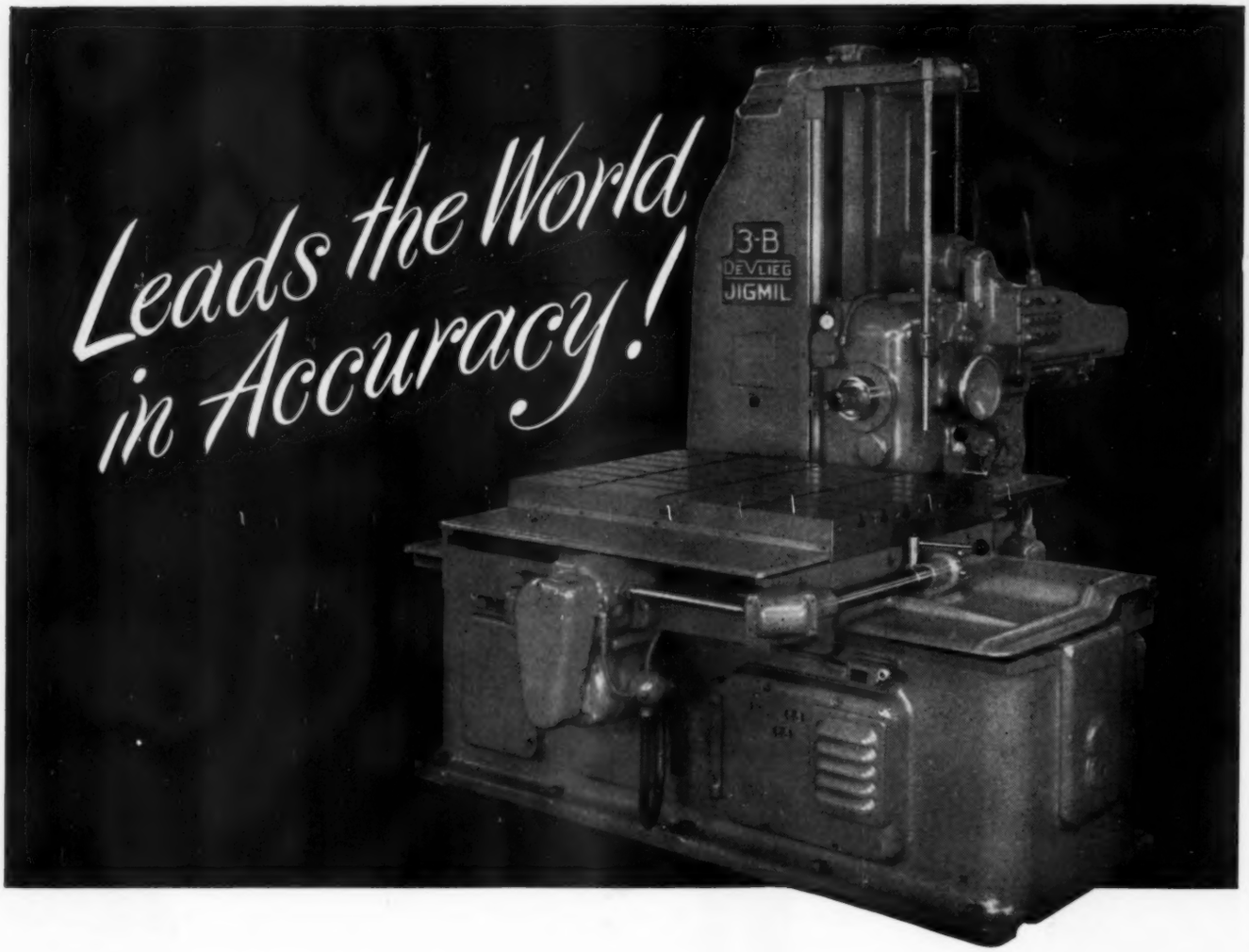
This design permits table to be located in the correct position for any job the machine will handle. The regular base construction permits taller work to be mounted on the base.

The machine has nine speeds and four feeds. The feed clutch and quick return mechanism are of entirely new design, employing a serrated clutch with diametrically opposed serrated blocks for engaging the feed which is adjustable from the outside.

All controls are conveniently located for any operator. Machine is sturdily built with one piece column. Furnished in 3 and 4 foot arms.

Complete details available in the Fosdick Sensitive Radial Bulletin—SRA. Write for yours.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO



The DeVlieg JIGMIL is now recognized as The World's Leader in the field of accurate boring, in addition to its unique capacity for high productivity on:

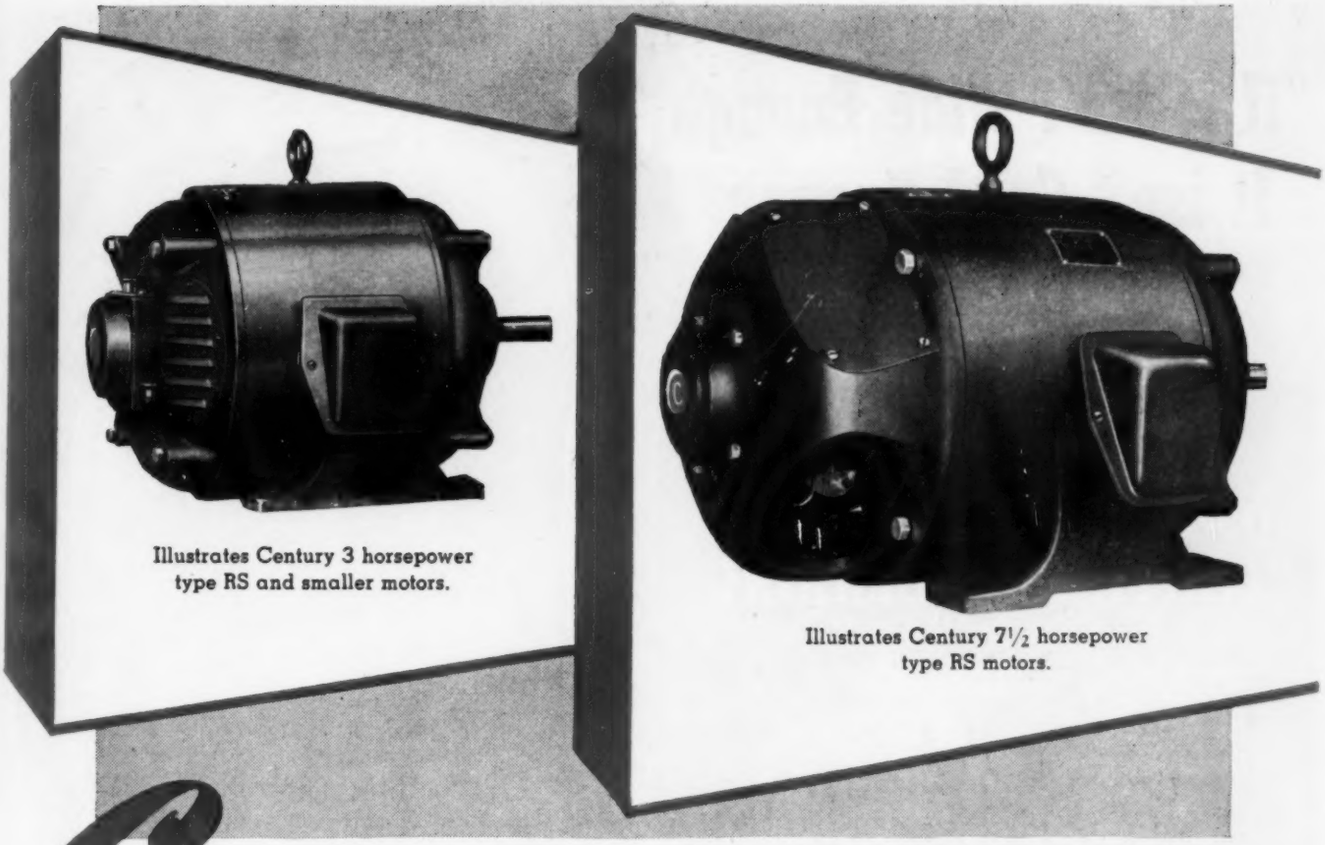
1. **Single part precision boring.**
2. **Tool, jig and die work.**
3. **Repetitive production work without jigs.**

Write today for new descriptive booklet.

DEVLIEG JIGMIL

DeVLIEG MACHINE COMPANY

450 FAIR AVE., FERNDALE 20, (DETROIT) MICH.



Illustrates Century 3 horsepower type RS and smaller motors.

Illustrates Century 7½ horsepower type RS motors.

Century Repulsion Start Induction Brush Lifting Single Phase Motors START HEAVY LOADS

Century Type RS motors are widely used to drive all kinds of motorized equipment wherever single phase power is distributed, particularly in suburban or farm districts. They have been satisfying owners for more than 43 years.

Because repulsion start motors have the highest starting torque per ampere of any single phase motor, they are ideal for equipment that must start under full load.

Century single phase motors are built in sizes up to 20 horsepower and other types in a wide range from 1/6 to 400 horsepower to provide top performance to meet every electric power application.

Specify Century for all your electric power requirements.

Century C MOTORS

564

CENTURY ELECTRIC COMPANY • 1806 Pine Street, • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

"If it isn't Wide Enough It isn't Good Enough"

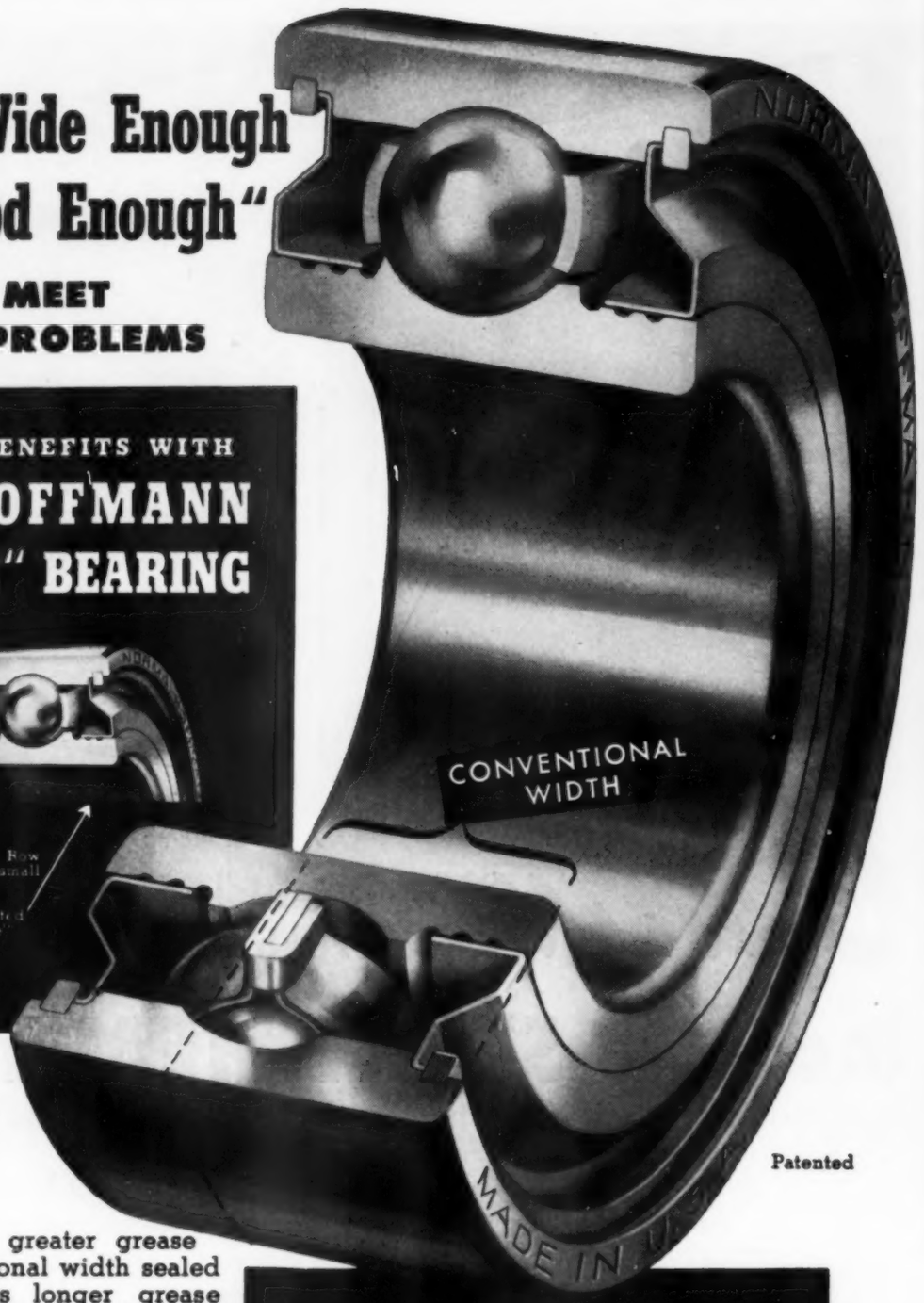
...TO MEET TODAY'S PROBLEMS

GET 3 DESIGN BENEFITS WITH

NORMA-HOFFMANN "CARTRIDGE" BEARING

CONVENTIONAL Single Row Width sealed bearing has small grease capacity.

NORMA-HOFFMANN patented double row width "Cartridge" Bearing has 100% greater grease capacity.



Patented

Here's What You Get

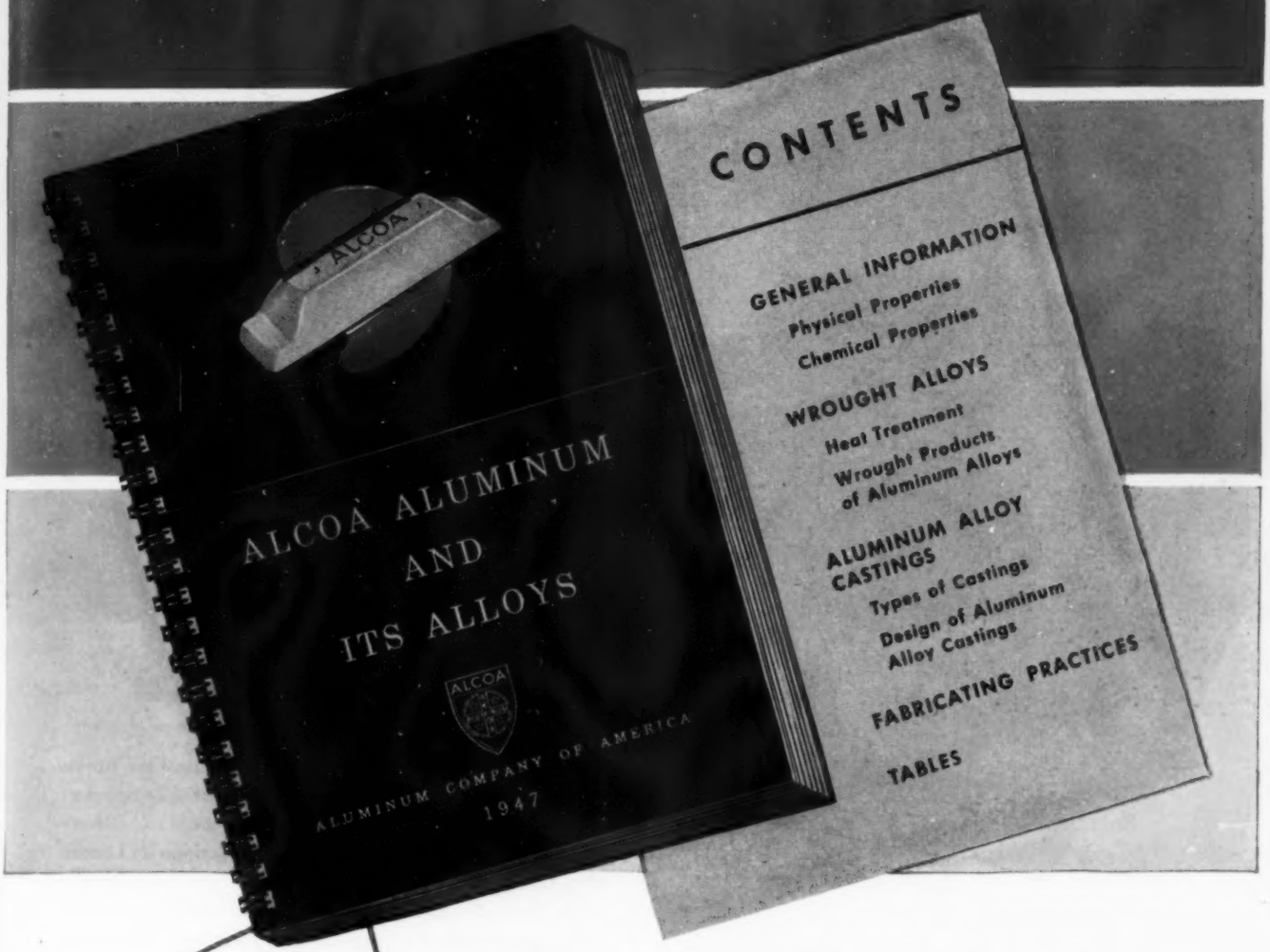
1. **Longer Life** A 100% greater grease capacity than conventional width sealed bearings. This means longer grease life... longer periods between relubrication—because a large volume of grease does not oxidize or dry out as readily as a thin film of grease.
2. **Greater Contact Area** 43% to 85% greater contact area between shaft and bearing bore and between housing and bearing O.D., as compared to conventional width bearing. This eliminates need for locknuts and results in greater shaft strength as it is unnecessary to cut locknut threads. Slippage and peening are also prevented.
3. **Full Load Carrying Capacity** Unlike many other sealed bearings, ***full size*** balls are used; hence, there is no reduction in load carrying capacity.

America's No. 1 SEALED BEARING by NORMA-HOFFMANN

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT

FIELD OFFICES: New York, Chicago, Cleveland, Detroit, Pittsburgh, Cincinnati, Los Angeles, San Francisco, Seattle, Phoenix

CHOCK-FULL OF THE LATEST DATA ON ALUMINUM



NEWEST REVISED EDITION

Yours for the asking!

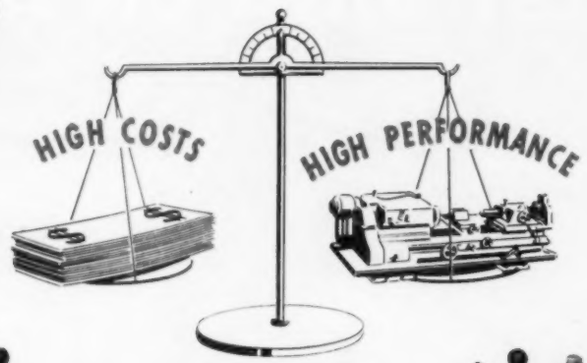
More than 150 pages of up-to-date information, tables, and data on all the Alcoa Aluminum Alloys, including new Alcoa temper designations. If you design, fabricate, or have the final say on using aluminum in your products, you need a copy of this *new* edition of "Alcoa Aluminum and Its Alloys" at your finger tips.

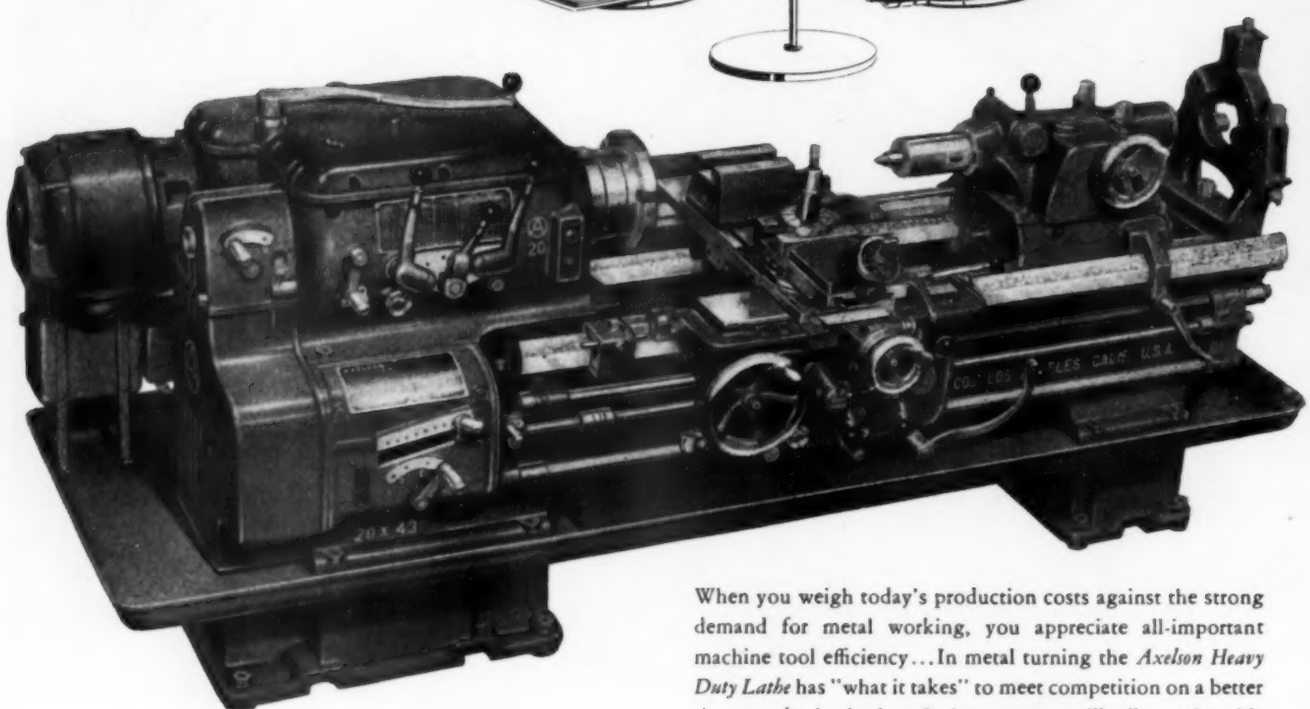
Write today for your copy. Address: ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania, or one of the 54 Alcoa sales offices nearest you.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM 1888 1948 60 YEARS OF SERVICE

Metal Turning Equalizer





Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25, and 32-inch sizes. Also 20 and 25-inch hollow spindle "Oil Country" Lathes.

When you weigh today's production costs against the strong demand for metal working, you appreciate all-important machine tool efficiency...In metal turning the *Axelson Heavy Duty Lathe* has "what it takes" to meet competition on a better than ever basis. Axelson Lathe operators will tell you that this is the best all-round machine they ever worked on...Easy control, speed selections, supreme accuracy, versatility between light and heavy work, with the rugged dependability of this lathe, all add up in the confidence of production managers too...For more work in less time, specify Axelson Lathes.

AXELSON MANUFACTURING COMPANY

6160 S. Boyle Ave. (Box 98, Vernon Station), Los Angeles 11, Calif. • 50 Church St., New York City 7

AXELSON

Lathes

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

DEPENDABLE FOR OVER A QUARTER CENTURY

No Idle Gesture

When operators vote "THUMBS UP" for Cimcool, they really mean it. And no wonder! For this new kind of cutting fluid is better seven ways, from the worker's point of view.

1. Cimcool is clean to work with—doesn't soil hands or clothes.
2. Can't smoke or burn—causes no harmful vapors.
3. Produces no objectionable odors.
4. No slippery film on hands, machine, work or floor.
5. Contains no chromates or other skin irritants.
6. Cimcool isn't subject to rancidity.
7. Tools and chips actually stay cool to touch.

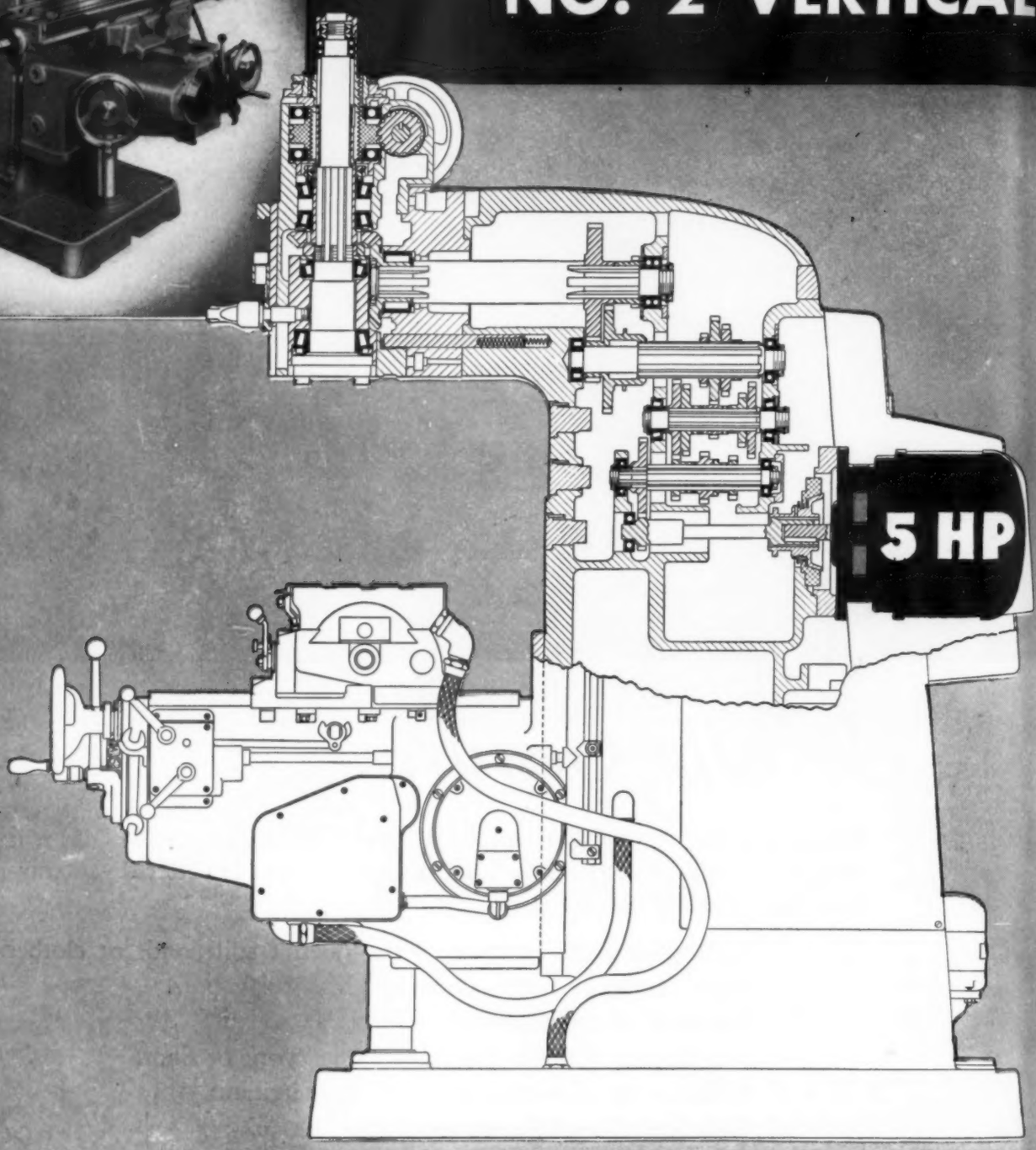
CIMCOOL DIVISION OF THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO, U.S.A.

CIMCOOL *for* **85%**

Trademark Reg U.S Pat Off

OF ALL METAL WORKING JOBS

A H
NO. 2 VERTICAL M



CAPACITY — Longitudinal feed 28″ — transverse feed, 12″ — vertical feed of knee 14¾″ — all power. Axial feed of spindle 3″, hand. Distance, center of spindle to face of column, 14″. 18 spindle speeds, 40 to 1530 r.p.m. 18 feed rates, ½″ to 20¼″ per minute. 75″ per minute power fast travel.

BROWN &

HORSEPOWER
AL MILLING MACHINE
FOR HEAVIER CUTS

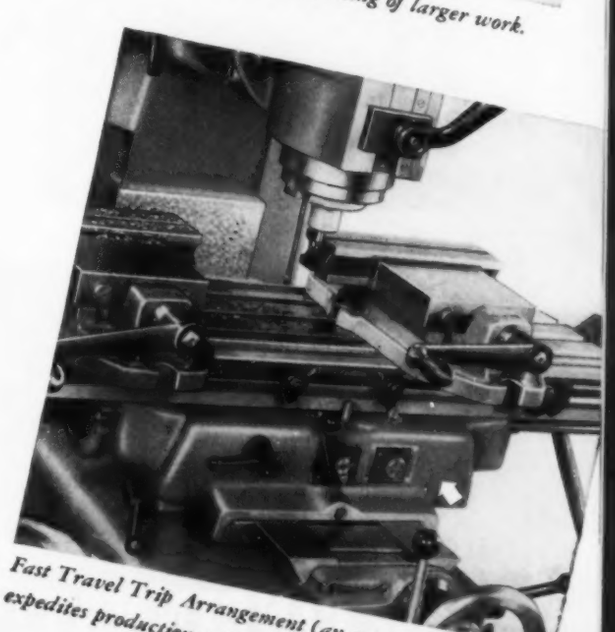
Swiveling spindle head of exclusive design offers quick angular settings.

BROAD UTILITY. This new addition to the Brown & Sharpe line embodies all the production-boosting features of the popular No. 2 Vertical Light Type Machine. In addition, it has greater throat distance, a No. 50 Milling Machine Standard taper hole in spindle, suitable spindle speeds for larger cutters and ample power plus rigidity for work requiring heavier cuts. Full 5 horsepower is available for spindle drive — with individual motors for table drive and coolant pump.

Engineered for smooth, efficient, powerful cutter driving . . . rigid column casting with integral cross bracing; short, large-diameter shafts supported directly in column; anti-friction bearings supporting all shafts in speed train; independent all-gear drives. Features like these assure highly-accurate production and long, trouble-free performance. Write for details. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

Greater throat distance permits milling of larger work.

USEFUL ATTACHMENTS. As with other Brown & Sharpe Machines, additional equipment is available for the new 5 H.P. No. 2 Machine — saving time and money on many operations. This consists of Rotary Attachments — Turret Type Spindle Stop — Index Centers — Fast Travel Trip Arrangement — Micrometer Table Setting Attachment — Scales and Verniers — Short Lead and Feed Reducing Attachment.



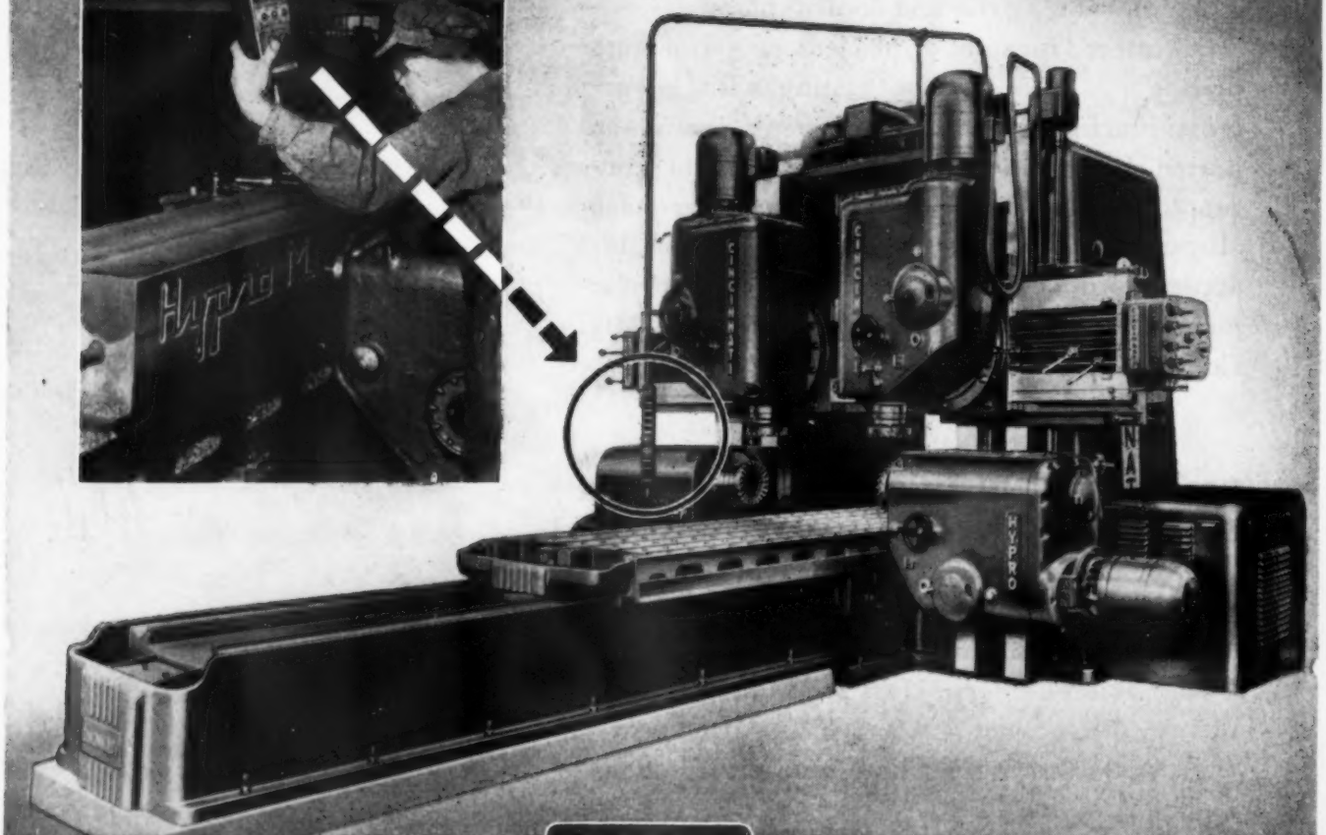
Fast Travel Trip Arrangement (an extra) expedites production milling.

SHARPE B·S

NOW COMPLETE FINGER-TIP CONTROL FROM PENDANT STATION...

Hypro·electronic PLANER MILLER DRIVE

Photo on left shows operator milling the words Hypro Miller in cast-iron block — an unusual demonstration of the versatility and absolute control of any head or table from pendant station exclusively.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

VULCAN EQUIPMENT LIST

. . . and a word about what it means to you

Prospective customers and friends have often asked us for an equipment list.

We have as often wondered why they wanted one. Naturally, we are proud of our tool room, but such a list, long or short, can only represent capital outlay for certain machine tools.

How this tool room equipment is used in producing your special tool needs is of prime importance.

Tool room equipment lined up from here to Main Street would be an impressive sight, but useless to you if the products flowing from this "impressive sight" were less than ordinary.

We wish we could list the mental equipment of our employees and executive personnel—it would be far more impressive and valuable to you. Perhaps our customers can tell you. Write us for their names—you are welcome to contact them direct, and find out for yourselves **the integrity, the brains, and the plus** we manage to get from our tool room.

Anyway, herewith the list. It will have changed considerably (for the better) a few months from now, for we are old in background and experience, young in ideas, and **modern as to equipment.**

ENGINEERING · PROCESSING · DESIGNING · BUILDING · DIES · JIGS · GAUGES · FIXTURES · SPECIAL MACHINERY MANUFACTURING · VARIOUS CONTRACT SERVICES

Vulcan Tool Co.

DAYTON 10 · OHIO · U S A

COMPLETE TOOLING PROGRAMS

WRITE FOR THIS LIST

Name_____

Title_____

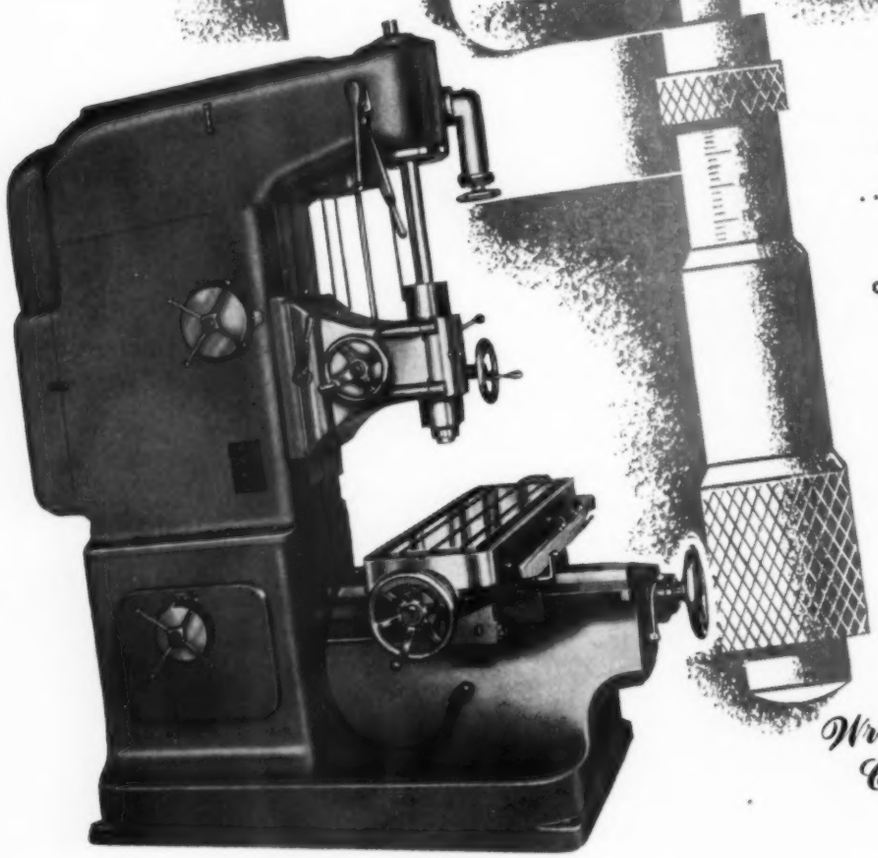
Firm_____

Address_____

EXCEPTIONAL ACCURACY, SPEED AND POWER

No. 50 PRECISION BORING AND VERTICAL MILLING MACHINE

★ Reduces Set-Up Time To A Minimum
★ Eliminates Time-Wasting Work Transfers
★ Multiple Operation On A Single Machine
★ Greater Output At Lower Unit Cost



The No. 50 is a machine built for precision as well as speed . . . with unusual ability to handle an extreme range of different and difficult jobs. Simple and convenient to operate — ruggedly constructed for many years of tough, trouble-free service — the Knight Miller offers worthwhile savings in greater output, lower production costs and improved quality of work.

Write for Complete Catalog Details

Sixteen spindle speeds, 40 to 2,000 r.p.m. • 9 spindle feeds, .005" to .010" • 100" table traverse per minute in both directions • Sixteen table feeds, $^{5}/_{16}$" to 20" per minute • 7½ h.p. drive.

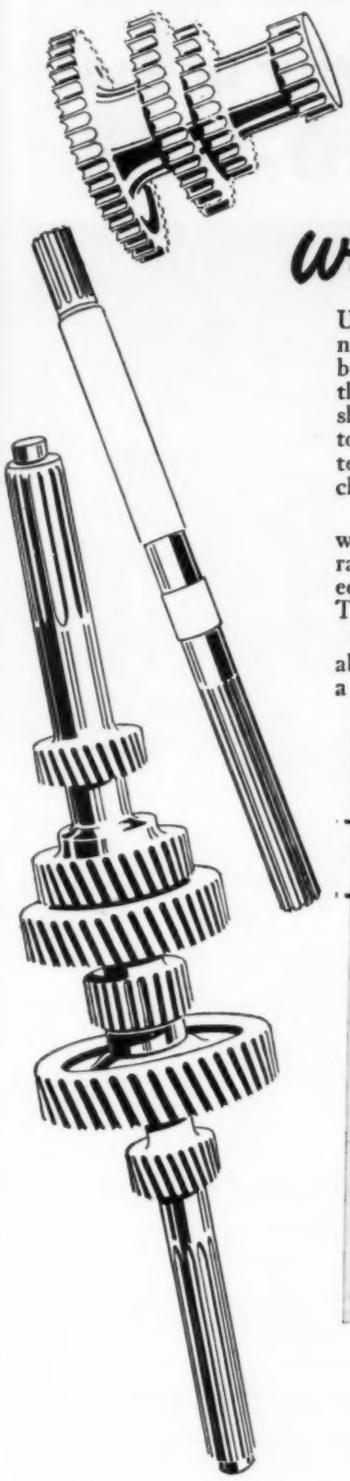
KNIGHT MILLERS VERSATILE ACCURATE RIGID

W. B. KNIGHT
MACHINERY COMPANY

MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

If you're making heavy duty gears, shafts and pinions for planes, trucks, buses and industrial machinery



Cut your Costs with U·S·S SUPERKORE *steels*

U·S·S SUPERKORE Steels meet a long-felt need. For here is a new series of improved carburizing steels which, although they cost *less* than more highly alloyed carburizing steels, show equal or greater hardenability—are easier to anneal—have improved carburizing characteristics—possess substantially improved machinability.

U·S·S SUPERKORE Steels were developed with two objectives in mind. To reduce your raw material and manufacturing costs. To equal or improve your product performance. They will do both.

U·S·S SUPERKORE Steels are now available in four different grades—each designed for a special type of heavy duty service. That's why it is important that they be properly selected and applied.

To help you get the full benefit of these steels in improving your product and reducing its cost, the cooperation of our service metallurgists — who developed U·S·S SUPERKORE Steels—is available. They will gladly help you in putting them to work, where, and *only where*, they should be used. They will show you how to iron out any application problems involved in their use.

The new "SUPERKORE Booklet" will give you further interesting information on these steels. For your copy write direct to Carnegie-Illinois Steel Corporation, Carnegie Building, Room 2008, Pittsburgh 30, Pennsylvania.

Here's where U·S·S SUPERKORE Steels can be used to advantage

Representative Applications	Present Steel	Recommended U·S·S SuperKore Alternate
Aircraft gears, shafts, pinions, etc.	E-3310, E-9310 or equivalent AMS Specification	U·S·S SuperKore A
Heavy duty truck and tractor gears, shafts, pinions, etc.	3316, 9316	U·S·S SuperKore AA
Heavily loaded gears, shafts, pinions etc. and carburized parts used in oil well drilling industry.	4815, 4820	U·S·S SuperKore B
Gears, shafts, pinions, etc.	4317, 4320	U·S·S SuperKore C

USS Carilloy Steels

ELECTRIC FURNACE OR OPEN HEARTH

COMPLETE PRODUCTION FACILITIES IN CHICAGO AND PITTSBURGH

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
Tennessee Coal, Iron & Railroad Company, Birmingham, *Southern Distributors*
United States Steel Supply Company, *Warehouse Distributors—Coast to coast*
United States Steel Export Company, New York

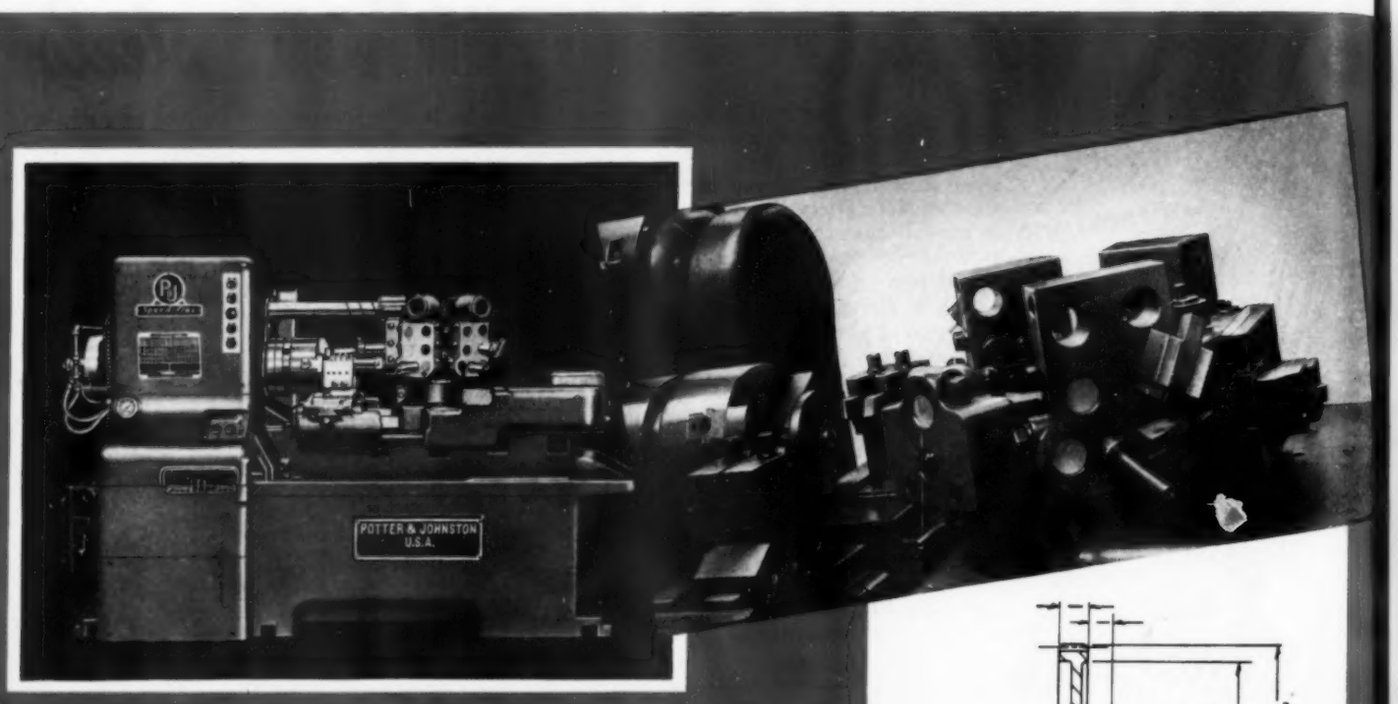
B-362

UNITED STATES STEEL

2.34 *minutes floor-to-floor time!*

proving the high productivity of the

NEW P&J 3 U SPEED-FLEX



Designed especially for fast, economical production of small parts up to 6" diameter, this new Automatic Turret Lathe, modern in every detail, is sturdily designed and amply powered for the use of carbide cutting tools.

Details of the job being handled disclose how advantage has been taken of the tooling flexibility inherent in this new machine.

Among the features contributing to speed, accuracy and convenience are: four automatic changes of speed and three automatic feed changes all handled by electro-pneumatic control of multiple disc clutches; change from rapid traverse to reverse feed, or vice versa, effected in one-fifth second; independent or simultaneous action of cross-slides in conjunction with selected turret faces or with all six turret faces.

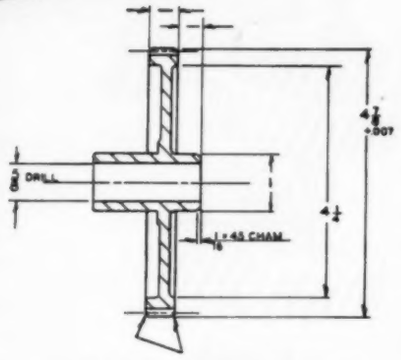
With the exception of loading and removal of finished work, operation is entirely automatic, enabling one attendant to handle several machines conveniently and easily.

●

POTTER & JOHNSTON MACHINE CO.

Pioneer Manufacturer of Automatic Turret Lathes

PAWTUCKET, RHODE ISLAND



DETAILS OF JOB

Part: Take-up Gear

Material: Cast Iron

Method and Operation:
Presenting short hub to spindle, grip on same with 3 chuck jaws.

Machine as follows:

1st T.F.: Core drill hole; rough turn and face long hub; spot face washer seat.

2nd T.F.: Rough turn O.D.; face both sides at rim; bore under rim; groove for slide tool.

3rd T.F.: Face web (Slide tool)

4th T.F.: Finish turn face and chamfer hub; turn O.D.; face one side at rim; finish bore hole; chamfer hole.

5th T.F.: Blank

6th T.F.: Ream hole 11/16" dia.; size turn 1.000" dia. hub.

Floor-to-floor time: 2.34 min. (average) Pieces per hour (100% efficiency): 25.5

●

Send parts or drawings of your small parts and ask P&J engineers to make a time study and report their findings.

7 Tool Steels for 90% of all Tool and Die Work

Just seven Bethlehem tool steels will handle 90 per cent of all tool and die work. These selected grades, described below, will reduce your tool-room problems because each analysis is reliable, uniform and easy to heat-treat. Each is thoroughly proved by its mastery of the types of work for which it is recommended.

By standardizing on these grades you can reduce the number of tool steels carried in stock, simplifying the procedure in your tool room and heat-treating department. This leads to reduced costs and a better finished product.

Each of these popular tool steels is stocked at Bethlehem's new mill depot in a wide range of sizes for prompt shipment to mill customers and distributors. You'll get service and technical assistance from the nearest Bethlehem district office or tool steel distributor.

For shipment direct to mill customers and distributors . . . from Bethlehem's new depot:

CARBON & CARBON-VANADIUM for general-purpose tools.

Standard range of carbon content for the broadest range of tool and die work. Water-hardening, with a tough core and hard case. Easy to machine and heat-treat.

Always the first choice where alloy steels are not required for special characteristics. Controlled hardenability and grain-size according to usage.

BTR ***(Bethlehem Tool Room)*** for safe-hardening. Mn-Cr-W-V; Safe-hardening (oil). Easy to machine. Combines toughness and wear-resistance.

For general tool and die jobs where a less-drastic quench is essential, especially where there are thin sections and webs. Ideal for intricate shapes that require easy machining.

LEHIGH H for maximum production.

High-carbon, high-chrome; air-hardening. Excellent wear-resistance. Deep hardening with high compressive-strength. Minimum distortion.

This grade is the top choice in die steel for long runs and close tolerances.

OMEGA for cold-battering tools.

Mn-Si-Mo-V; oil- or water-hardening. Combines hardness with toughness and high strength. Easy to forge, machine, heat-treat.

For severe shock service on cold work, there is no better steel than Omega—for pneumatic chisels, cold-battering tools, clutch pins, punches, etc.

67 CHISEL for general-purpose shock tools.

Si-Cr-W; oil-hardening. High degree of toughness and hardness with good abrasive and cutting properties.

For severe shock applications, especially hot work applications at temperatures up to 1050 F. With special treatment to obtain high surface hardness, this grade is the first choice for master hobs.

SPECIAL HIGH-SPEED

18-4-1 composition. Balanced qualities of red-hardness, toughness, abrasion-resistance. Holds a keen edge.

This old favorite is the standard type of high-speed tool steel and is the best general-purpose grade for cutting jobs. Widely used for taps, twist drills, lathe and planer tools, reamers, cutters, etc.

66 HIGH-SPEED

6-5-4-2 composition. A low-tungsten, high-moly steel. Tough and wear-resistant. Excellent red-hardness.

This grade has wide application for single-point cutting tools. With salt-bath hardening it is a reliable choice for twist drills, reamers, and similar tools.

★ BETHLEHEM STEEL ★

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM TOOL STEELS for EVERY JOB

Here are a few of the reasons why....

more and more manufacturers specify

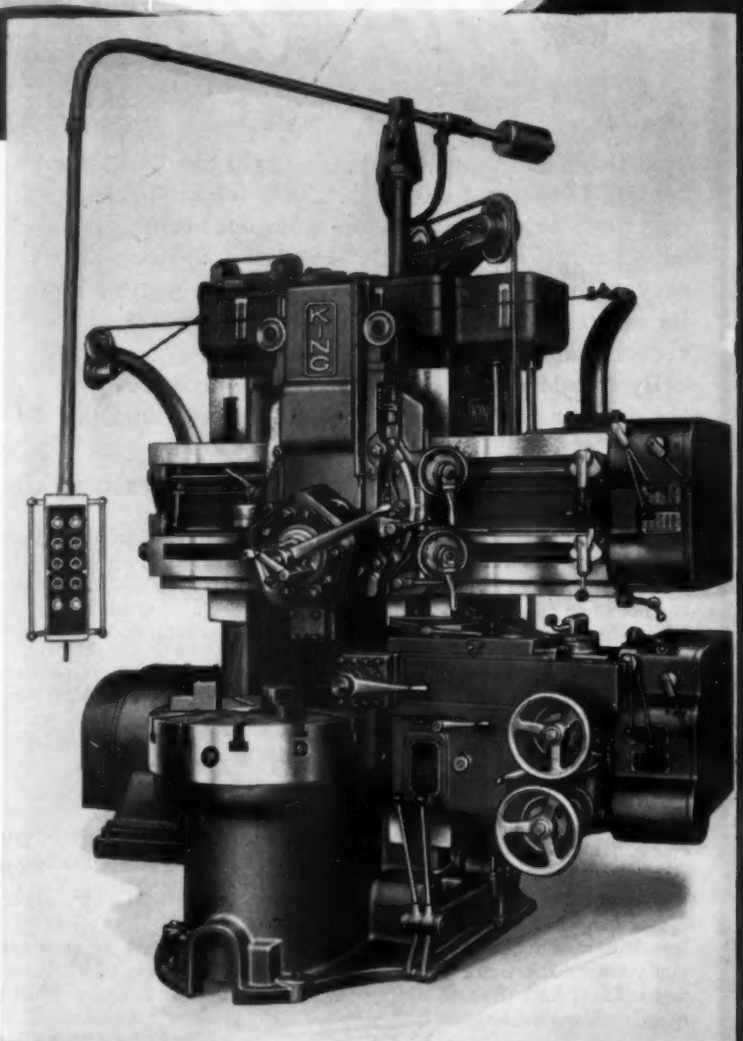
KING NEW SERIES VERTICAL BORING AND TURNING MACHINES

for their Precision Operations

Heavier construction throughout, rigidity that permits skim or deep cuts with accuracy, all controls at the front for easier, faster operation with less operator fatigue —are a few of the many features of the new series KING Boring and Turning Machines.

Ease of control is emphasized. For example, angular hand adjustment levers with micrometer dials, for vertical and horizontal movement of the head are an integral part of the head and move with it. This permits on-the-spot adjustments —saves time and insures accuracy.

Contact a King Engineer on your vertical boring and turning jobs for greater accuracy, increased production and lower-costs.



King 30" machine with R. H. Swivel Turret and Side Head.

American Steel Foundries

KING MACHINE TOOL DIV.
CINCINNATI 29, OHIO

Builders of Vertical Boring and Turning Machines and Sebastian Lathes

No matter what "grandpappy said"...

We can't overlook this CASTING BARGAIN!

Maybe your founder said "Stick to iron, boys"—but he never dreamed of a day when you'd be able to compare the price tags of American Magnesium Castings with gray iron!

Of course, Grandpappy never had a chance to count the savings of castings as *smooth* as American Magnesium Castings' as-cast surface. The savings of superlative *machinability*—with the first cut often the finish cut. Or the savings of *lightweight* castings—75% lighter than iron—35% lighter than aluminum! They can be *handled* through production, rather than *trucked* or *hoisted*.

Nor did Grandpappy face conditions where he had to cut production schedules because of casting shortages. Had he known all these things—and had a chance to outsmart competition to boot, with a modern, lightweight product in plentiful supply, he'd have been the first to call the nearest Alcoa Sales Office, or write ALUMINUM COMPANY OF AMERICA, sales agent for American Magnesium products, 1709 Gulf Bldg., Pittsburgh 19, Pennsylvania.

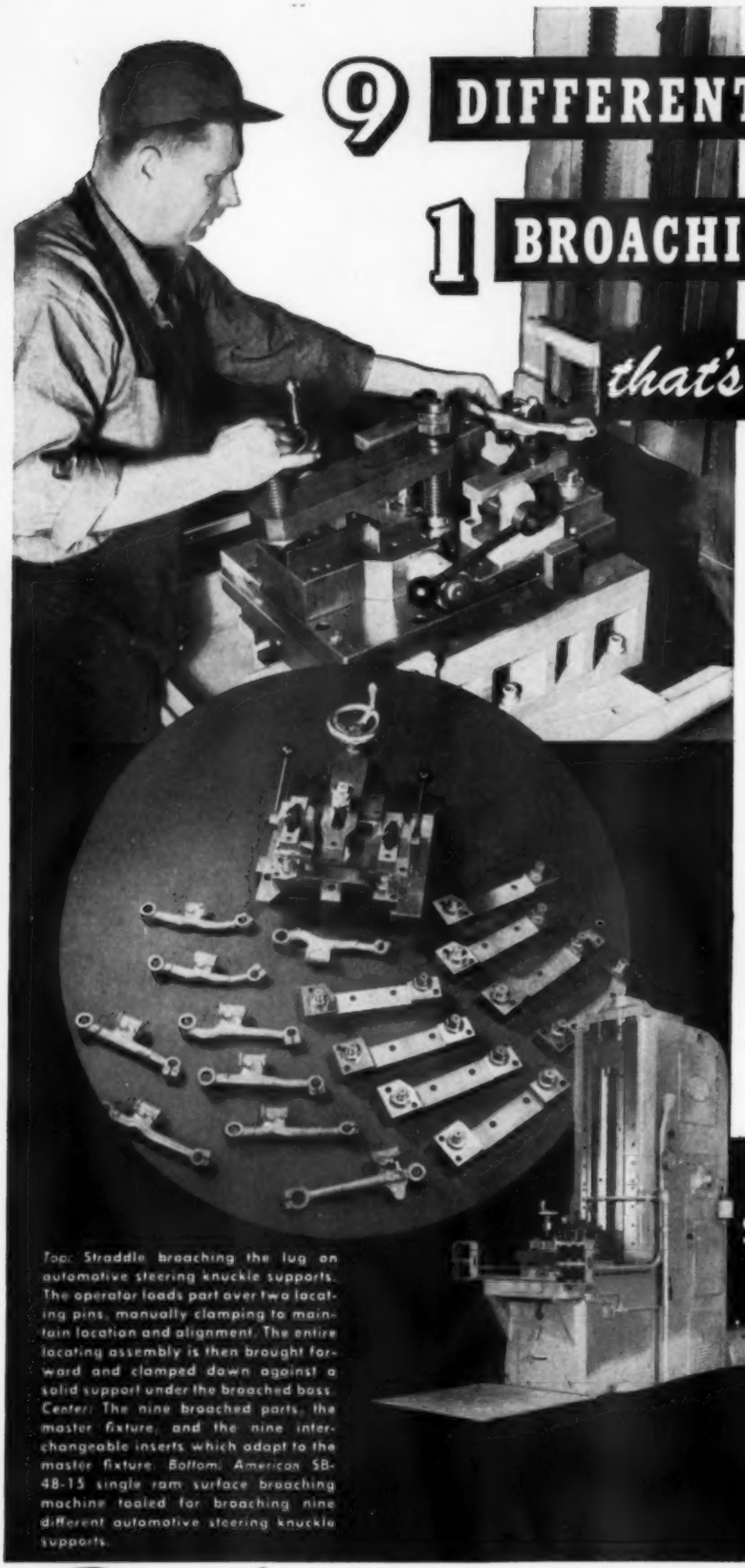
MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

9 DIFFERENT PARTS on 1 BROACHING FIXTURE . . .

that's Tooling Economy!



This *American*-designed broaching job achieves real tooling economy. One master fixture and nine easily interchangeable inserts are used on an *American* SB-48-15 single ram surface broaching machine with receding work table. Thus equipped, the machine broaches the king pin boss on nine different automotive steering knuckle supports. Taper wedge adjustments are used behind the broach sections to accommodate variations in the length of the king pin boss on the parts.

Top: Straddle broaching the lug on automotive steering knuckle supports. The operator loads part over two locating pins, manually clamping to maintain location and alignment. The entire locating assembly is then brought forward and clamped down against a solid support under the broached boss. *Center:* The nine broached parts, the master fixture, and the nine interchangeable inserts which adapt to the master fixture. *Bottom:* American SB-48-15 single ram surface broaching machine tooled for broaching nine different automotive steering knuckle supports.

Write for *FREE* Circular on SURFACE BROACHING MACHINES

A new circular gives complete details and specifications on *American* surface broaching machines. Write for your copy today. Ask for Circular 300A

AMERICAN

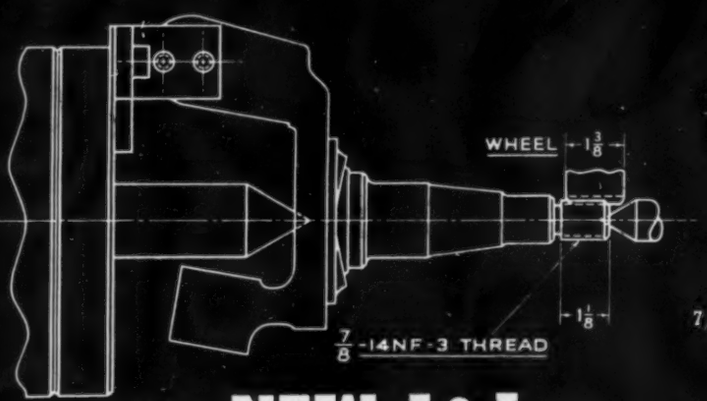
American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

CAN YOU COMPETE AGAINST THREAD PRODUCTION LIKE



on the **NEW J & L**

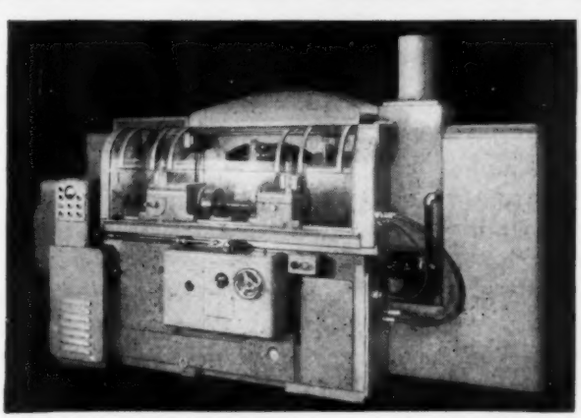
113

7/8"-14NF CLASS THREE THREADS

PER HOUR

GROUND FROM THE SOLID AFTER HARDENING

6x30 AUTOMATIC MULTIRIB THREAD & FORM GRINDER



An outstanding advance in automatic thread grinder design. The 6 x 30" production thread grinder has—

Universal Thread Range	Perfected vapor control
Complete versatility	Wide speed range
Crush or Diamond Dressing	Roomy working area
Automatic guarding	Selective automatic cycles

THINK what you could save with *any one* of these advantages

- •No handling damage — the thread is ground last
- ••No costly rethreading after heat treatment
- •••No expensive retooling when specifications change
- ••••Reduced cost of gage maintenance

The Jones & Lamson 6 x 30" Production Thread Grinder provides *ALL FOUR*—and guarantees high production of fine quality threads in even the toughest, hardest materials.

JONES & LAMSON MACHINE COMPANY

Springfield, Vermont, U. S. A.

Manufacturer of: Universal Turret Lathes · Fay Automatic Lathes · Automatic Double-End Milling and Centering Machines · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers · Ground Thread Flat Rolling Dies

Jones & Lamson
AUTOMATIC THREAD GRINDERS

Another Transfer-matic by Cross Spectacular

Created by Cross for one of the "Big Three" automobile companies, this new Transfer-matic insures low cost axle housing production through its **extraordinary automaticity.** Now one man can easily produce 150 housings per hour — an increase of as much as 650% in productivity. Yet surprisingly, capital investment is lower than equipment for conventional methods.

After being loaded, two housings are automatically advanced from one machine to the next, located, hydraulically clamped, and machined at both ends simultaneously with carbide tipped tools. A centralized coolant system with automatic chip disposal functions with the cycle.

The operational sequence is: Rough bore wheel bearing seats—Turn bolt diameter behind flange and O.D. of flange—Semi-finish bore wheel bearing seats—Straddle face end flanges—Finish face flange ends.

Flexibility is provided to meet reasonable changes in product design and in sequence of operations. **Machines can be added, removed, or shifted** and the transfer mechanism altered accordingly since it is independent and moves the work from machine to machine only. Locating and clamping are done by the work holding fixtures which are integral with each individual machine.

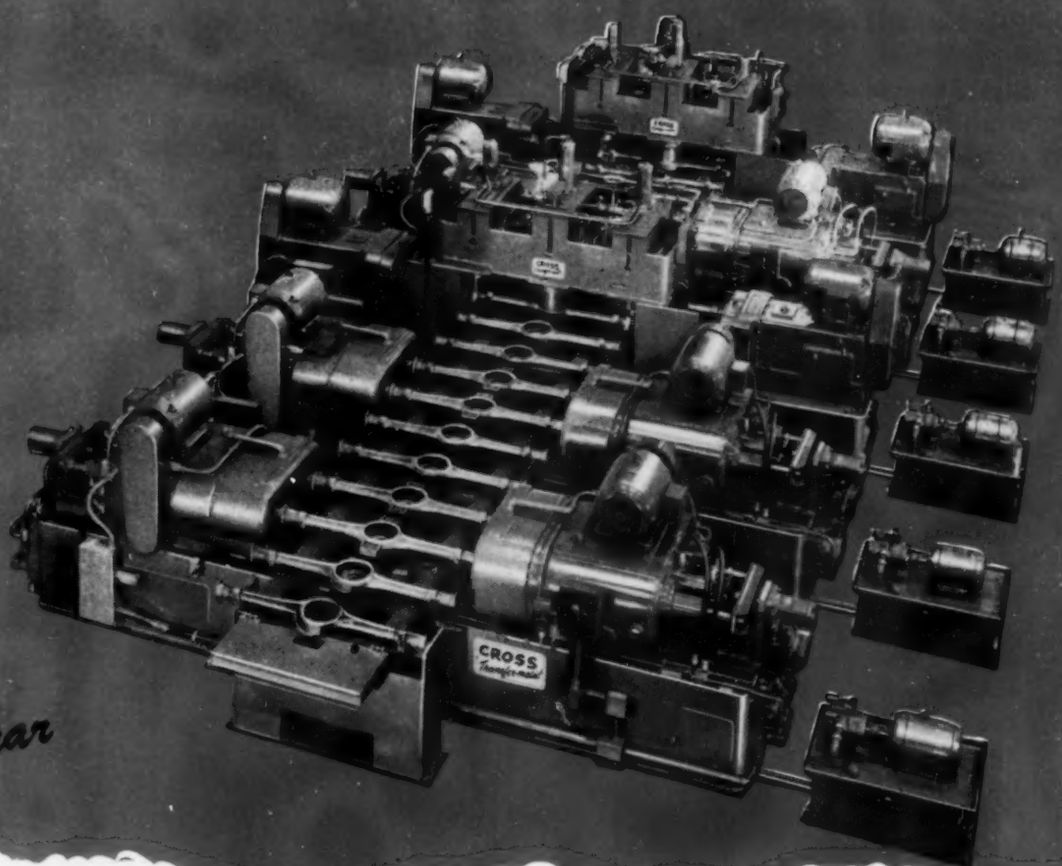
Maintenance is simplified. Self-contained units are used which can be quickly repaired or replaced. Hydraulic valves are gasket mounted and can be removed without disconnecting piping. Valves, limit switches together with hydraulic pump and tank units are conveniently located at the ends of the machines. During down time, each machine can be operated independently from its own push button station; work can easily by-pass any machine.

Investigate Cross Transfer-matics—the newest machine tool development for continuous automatic production.

Performance!

1 Operator • 150 Axle Housings Hourly

- Bores, *turns*, and faces two housings at both ends simultaneously.
- Continuous automatic cycle paces production.
- Utmost flexibility to meet changes
- Simplified maintenance to reduce down time.
- Low capital investment.



Rear

THE **CROSS** COMPANY

Established 1898

SPECIAL MACHINE TOOLS

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

new Bullard type economies widen scope of MULT-AU-MATIC method

Higher Speeds Meet New Job Requirements. Designed to lower production costs of small and medium sized jobs in cast iron, steel and light metal alloys, the new BULLARD Type "K" Mult-Au-Matic provides a wide range of spindle speeds up to 900 rpm to get full productive capacity out of modern cutting tools.

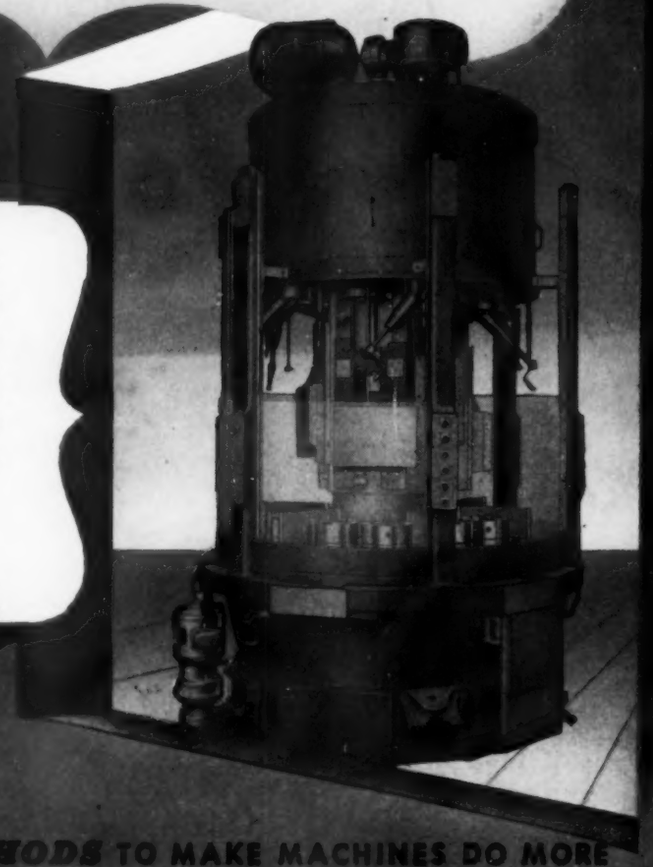
Saves Time Between Cuts. A newly developed index control mechanism permits faster return and advance of tool carrying heads and faster carrier index.

Higher Degree of Accuracy. New method of carrier index registry maintains repetitive accuracy from station to station, producing work to extremely close tolerances.

Improved Hydraulic Chucking Increases Efficiency. Work is chucked quickly by foot treadle control and automatically released as spindles return to loading station. Chucking pressure is adjustable to suit work characteristics.

Twin Spindles Double Production. Two of the four Type "K" models have twin spindles that deliver two finished pieces for every index cycle . . . a promise of lower production cost that is worth investigating further.

Write for complete information about the new Type "K" version of the Mult-Au-Matic method, one of the leading contributors to our modern American production system. THE BULLARD COMPANY, Bridgeport 2, Connecticut.



BULLARD Type "K" Mult-Au-Matics for work up to 10" in diameter come in four models: 6 or 12 spindles with speeds from 100 to 900 rpm, and 8 or 16 spindles with speeds from 98 to 880 rpm. 41 speed changes, 82 rates of feed, selective feeds and common speeds at all stations.

BULLARD

BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

Helicopters made by Bell Aircraft were recently used to spray swarms of flying locusts in South America. A 98% kill was reported.

get ready with CONE for tomorrow

The Naval Research Laboratories are "growing" artificial quartz crystals for use in electronic devices.

be ready with CONE for today

The U. S. Bureau of Standards has developed a method of plating with nickel or cobalt that requires no electric current.

get ready with CONE for tomorrow

A magnified chart showing the shape, height and spacing of long waves, steps, fine roughness and other irregularities on machined or finished surfaces is provided by the Proficorder — a new Physicists Research Co. shop instrument.

be ready with CONE for today

Air speeds up to 7,000 miles per hour can be simulated for study by towing models at much slower speeds in a shallow tank of water. The method is in use in North American Aviation's Aerophysics Laboratory.

get ready with CONE for tomorrow

Goodyear Tire and Rubber Co. cements automobile brake linings directly to the brake shoes eliminating rivets. More surface is provided and longer wear without scoring results.

be ready with CONE for today

Fibrous insulation composed of pure silica and capable of withstanding 2,000 deg. F. is being made by H. I. Thompson Co. of Los Angeles.

get ready with CONE for tomorrow

Photographic prints produced in a specially equipped automobile immediately after exposure were transmitted by radio to the editor's desk at the NEW YORK DAILY MIRROR eight minutes after the event pictured.

American-La France-Foamite Corp. is making a two-car parking meter which halves the cost of installation.

be ready with CONE for today

Color printing by radio facsimile is now possible with a process called "Colorfax" developed by Finch Telecommunications Inc.

get ready with CONE for tomorrow

The underground gassification of coal for the commercial production of power has been proved feasible by the Alabama Power Co.

be ready with CONE for today

The Automatic Signal Division of Eastern Industries, Inc. has a device for measuring the speed of vehicles in traffic that is based on the reflection of a radio wave from the surface of a moving vehicle.

Pennsylvania Railroad is using a mobile X-ray machine to examine metals in locomotives, cars, rails and other equipment.

get ready with CONE for tomorrow

In California the Bakersfield Machine Co. sells welders' supplies directly from a truck to oil fields, farmers, factories and welding shops.

be ready with CONE for today

American Locomotive Co. has a waste-heat boiler that operates on diesel engine exhaust.

get ready with CONE for tomorrow

A small air-driven drill made by Aro Equipment Corp. has a ¼-inch chuck and turns 26,000 r.p.m.

be ready with CONE for today

Fruehauf Trailer Co. is making prefabricated truck bodies that can be assembled by the dealer in a few hours.

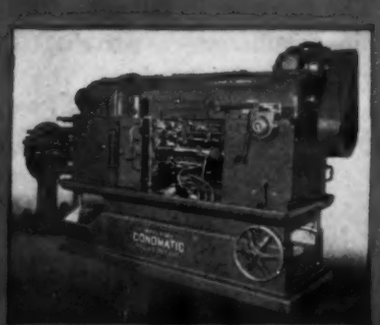
FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

Can YOU equal this

in 12 seconds?

The above shaft was machined by a 1⅝" 8-Spindle Conomatic in 12 secs., with 16 tools, from SAE 1030 — ½" rd. stock.

Ask your CONE *representative to show you our new color motion picture*



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

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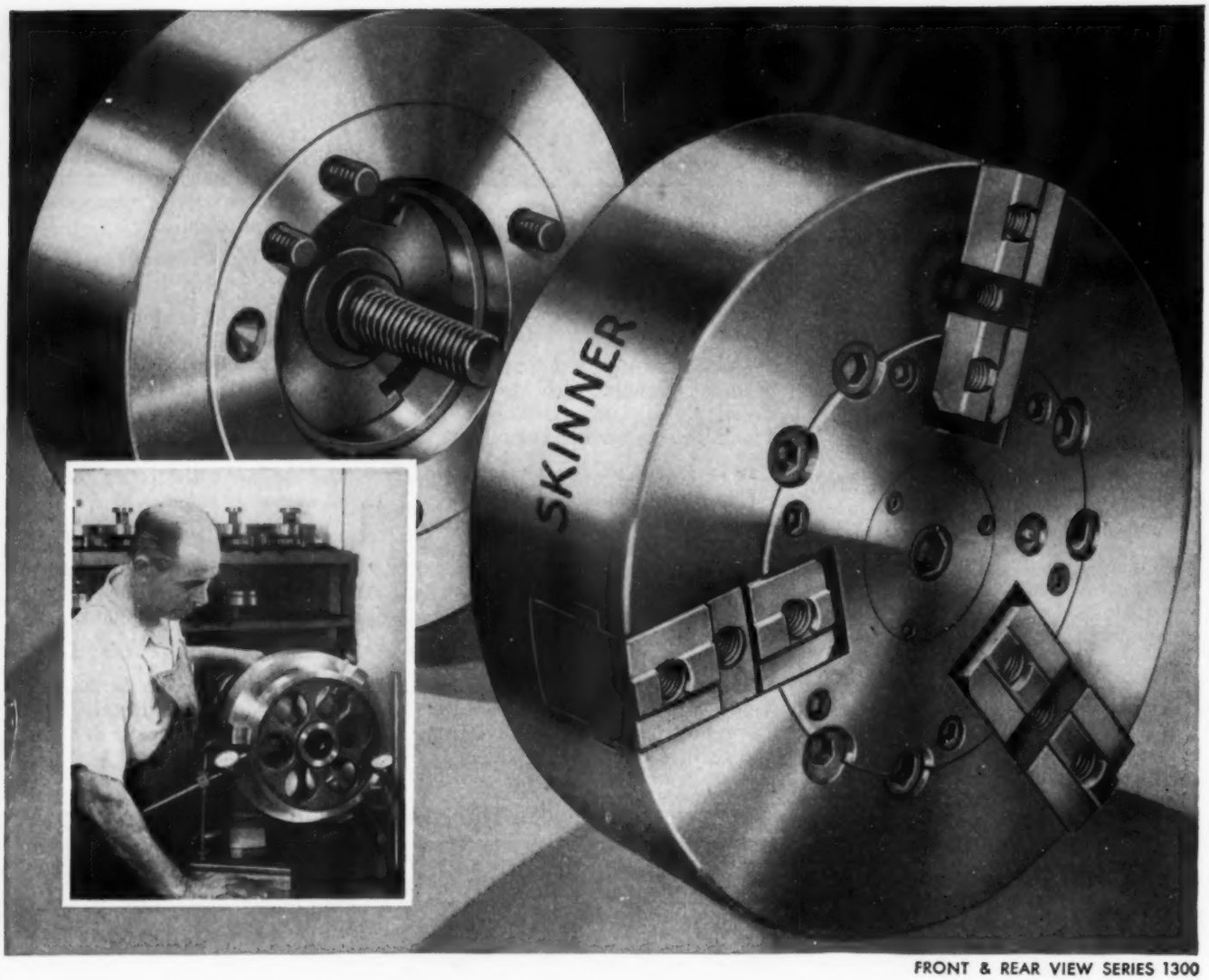


FRONT & REAR VIEW SERIES 1300

PRECISELY, Mr. Jones - *and faster, too!*

Yes, Mr. Jones, a Skinner Power Chuck provides a means to chuck work quickly, easily and accurately. This means that a machine equipped with a Skinner Air Chuck will be removing metal more hours of every work day, but without burdening the operator. The increase in output will result in production-cost savings that will give you an edge in the increasingly competitive picture of today.

And that's not all, Mr. Jones. There are other features of Skinner Power Chucks about which you ought to know. Take a look at their rugged construction — balanced, forged-steel bodies, machined all over, provided with wide jaw ribs to keep jaws properly aligned and in the same plane — every part, plus the assembled unit, checked and rechecked. There are years of productive service in every Skinner Chuck. Safety is important, too; that's why Skinner has paid special attention to the wedge-angle. *Once the jaws grip a piece in any position, they will not release even if the air supply is completely cut off!*

Power chucking is a modern time-saving method that offers a simple way to greatly reduce your production costs. Skinner offers a complete line of self-centering and combination power chucks and allied equipment such as air cylinders, operating valves, gages and filters, plus a nationwide dealer organization that's ready to apply their knowledge and experience to your problems — on the spot.

The Skinner Chuck Co.

342 CHURCH STREET, NEW BRITAIN, CONN.

Skinner Chucks

SKINNER CHUCKS — THE CREST OF QUALITY

HAND & POWER OPERATED MACHINE CHUCKS – AIR CHUCK EQUIPMENT – FACE PLATE JAWS – MACHINE VISES

Hit the BULLSEYE *in '48*

KEMPSMITH ATTACHMENTS Will Help You to Increase This Year's Profits!

Start the New Year right in your production milling department by using Kempsmith Standard Attachments. These precision-built tools enable you to perform a great variety of intricate milling operations at low cost. They make it possible for you to get the maximum benefit from your standard milling machine, eliminating costly investments in special, single-purpose milling equipment. And remember, Kempsmith Attachments are backed by more than 59 years of specialized experience building milling machines and equipment exclusively.

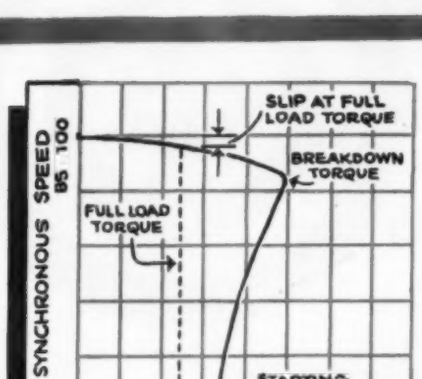
Contact your local Small Tools Distributor. If he does not handle the Kempsmith line, write direct to factory.

KEMPSMITH MACHINE CO., 1823 S. 71st Street, Milwaukee 14, Wis., U. S. A.

KEMPSMITH

Precision Built Milling Machines Since 1888

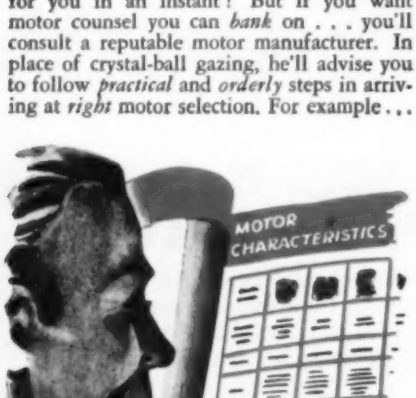
Here's One Way to Choose Motors...



Sure, Your Local "Swami" can pick a motor for you in an instant! But if you want motor counsel you can *bank* on . . . you'll consult a reputable motor manufacturer. In place of crystal-ball gazing, he'll advise you to follow *practical* and *orderly* steps in arriving at *right* motor selection. For example . . .

First, Study Your Power Supply . . . voltage, frequency, number of phases; the p.f. required by your utility. Judicious selection will help balance your motor capacity . . . lower power costs. And check the voltage regulation — choose motors with enough torque to start and carry the load. Next . . .

Study the Driven Machine and surroundings. What hp? What starting torque? Will you need a horizontal or vertical motor — direct-connected, belt-driven or gear-operated? How about surroundings — ambient temperature, moisture, corrosion, dust. Each calls for a particular type of protection. Now . . .



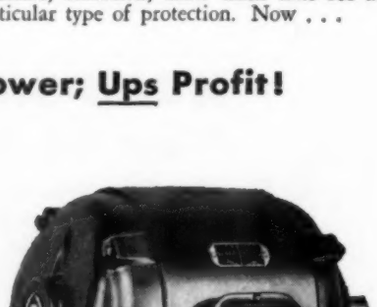
Study Your Motor Characteristics. *A-c motors?* For most jobs they're satisfactory and economical. *D-c motors?* For wide speed range; for fast acceleration or reversal they may prove your best bet. *Synchronous motors?* When applicable they give you low-cost p.f. correction. You're *still* undecided? Call in your nearby Allis-Chalmers motor expert. He'll be glad to help you decide—with recommendations backed by 50 years of motor-building!

Wise Motor Choice Saves Power; Ups Profit!

YES, CRYSTAL-BALL GAZING methods are out when you're trying to get *maximum* return on your electric motor investment. Slip-shod selection usually results in over-capacity, high power and maintenance bills — the kind of costs that in the competitive era of tomorrow you won't be able to afford!

That's why it pays to know more about *all* types of motors . . . their operation . . . limitations . . . maintenance. And there, too, is where your Allis-Chalmers motor expert can be of real help! ALLIS-CHALMERS, MILWAUKEE.

A 2328



A CENTURY OF SERVICE to Industry THAT MADE America Great

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment-
Biggest of All in Range of Industrial Products

This 12,500% increase *sounds fantastic!*

But True!

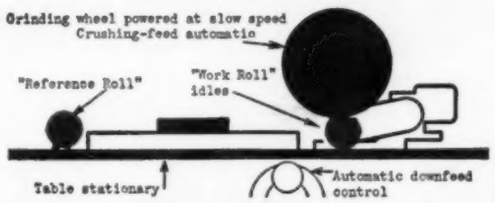
One of the major drawbacks to crush form grinding precision flat form contours has been the inability to produce on a practical production basis. This obstacle has been eliminated in two ways by the new Thompson Truforming Process.

First: Truform Grinders are engineered and built as a single unit, eliminating the failures of make-shift crushing arrangements and attachments.

Second: TWO CRUSHING ROLLS ARE USED. This is a major advancement, because it greatly extends crushing roll life and makes possible, for the first time, quantity production without constantly disturbing the set-up to re-process the crushing roll.

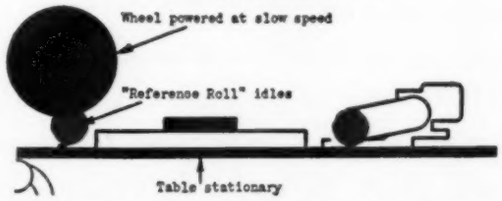
How two rolls operate in the Truforming Process is briefly illustrated and described below. The normal crushing or truing position is shown first.

Normal Crushing Position
Also Truing or Dressing



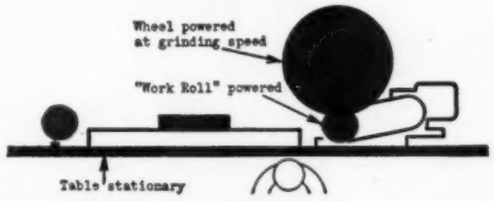
This is the position for the initial crushing of the wheel—and for subsequent truing or dressings when production grinding. On an eight pitch modified buttress thread form, 125 dressings were provided by the "work roll" before losing form.

Touching-up Position



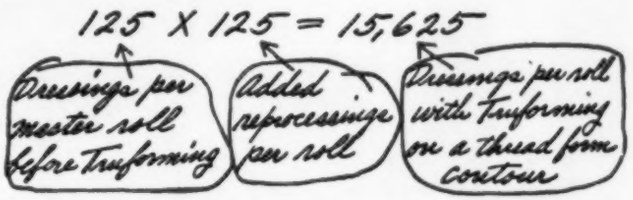
When the "work roll" loses form the table is moved to bring the grinding wheel over the "reference roll" for touching up, as shown above.

Re-processing Position



Because both rolls are table mounted, are in perfect alignment, and can be brought in the same relation to the grinding wheel, the original degree of accuracy can be quickly transferred from the "reference roll" back into the grinding wheel . . . and then ground back into the "work roll" as shown above.

The machine is then ready for production grinding again without disturbing the set-up or removing anything from the machine. In this way the "work roll" can be re-processed whenever it loses form and can be used for hundreds of additional dressings, or until it is worn out. Duplicate crushing rolls can be ground in the same way on all Thompson Truform Grinders.


125 X 125 = 15,625
Dressings per master roll before Truforming
Added reprocessings per roll
Dressings per roll with Truforming on a thread form contour

What this means in savings is illustrated by the following example, involving a modified buttress thread form with an eight pitch form. Where two rolls are used in the Thompson Truform Process, it was possible to get *over 15,625 dressings* from the "work roll" before it was worn out. This meant an increase in continuous production (without changing or disturbing set-up) of 12,500%.

Write for new 16-page folder—"How to produce accurate contours faster . . . better in hard metals with Thompson Truforming."

Address Dept. 10

The Thompson Grinder Company • Springfield, Ohio

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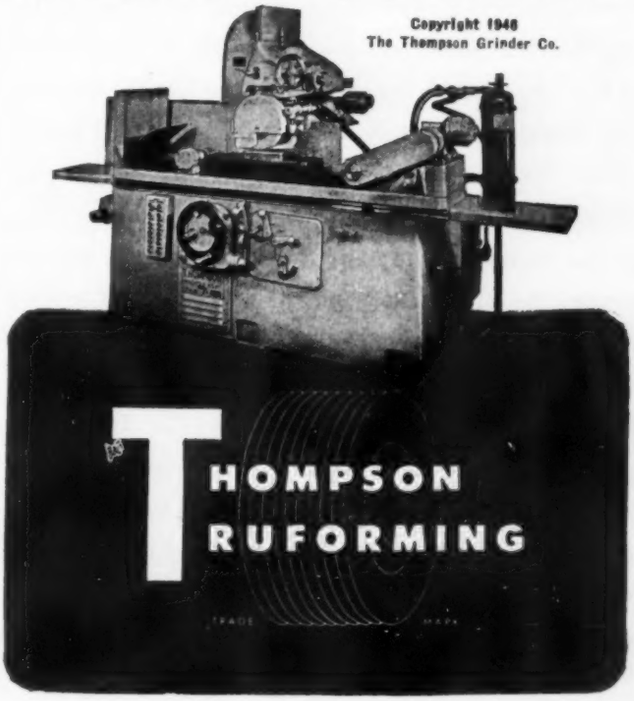
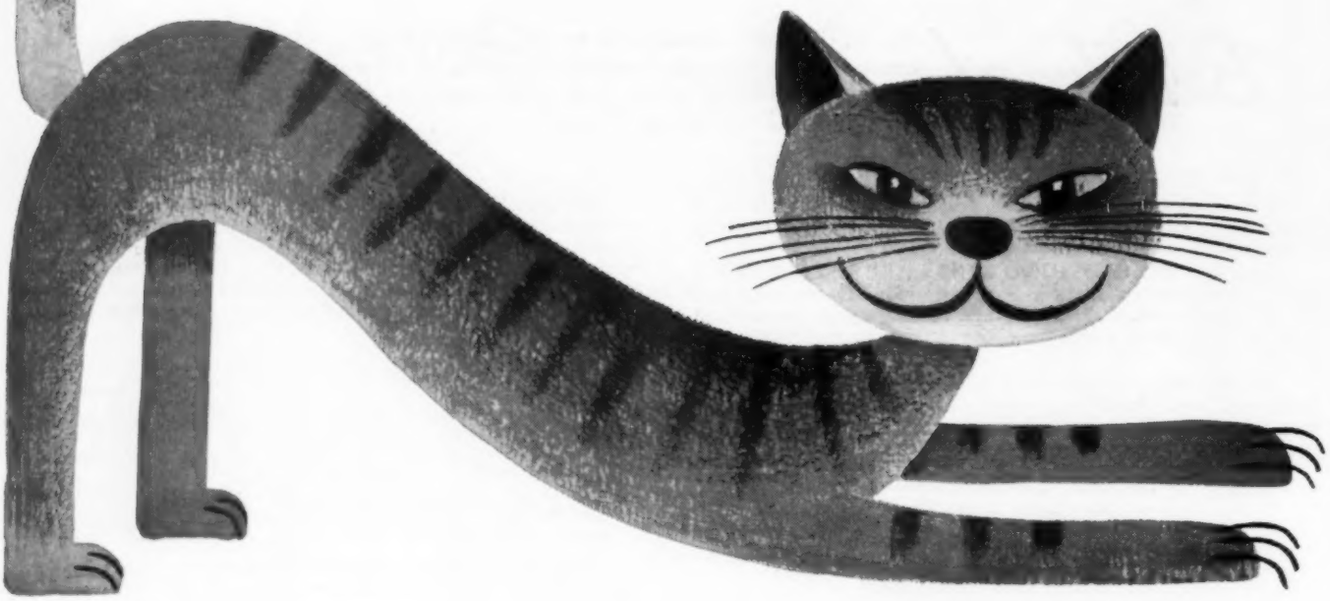
The Thompson Grinder Co.



A grinding wheel has nine lives, too . .



if it's a ROBERTSON COOL-CUT

Have you ever seen a cat sharpen its claws? Have you noticed how it spreads them to the limit before striking, leaving plenty of space between the "cutters"?

That, in effect, is the way Robertson Cool-Cut Grinding Wheels work. Only a few grains are used at one time. The spaces in between are available for "chip clearance." And the bond is so strong that the cutting grains are held to the limit of their usefulness. This increases the life of the wheel and assures cool cutting even on the hardest of metals. The performance is so startling that many grinders refuse to believe it possible . . . until they try a Robertson Cool-Cut themselves.

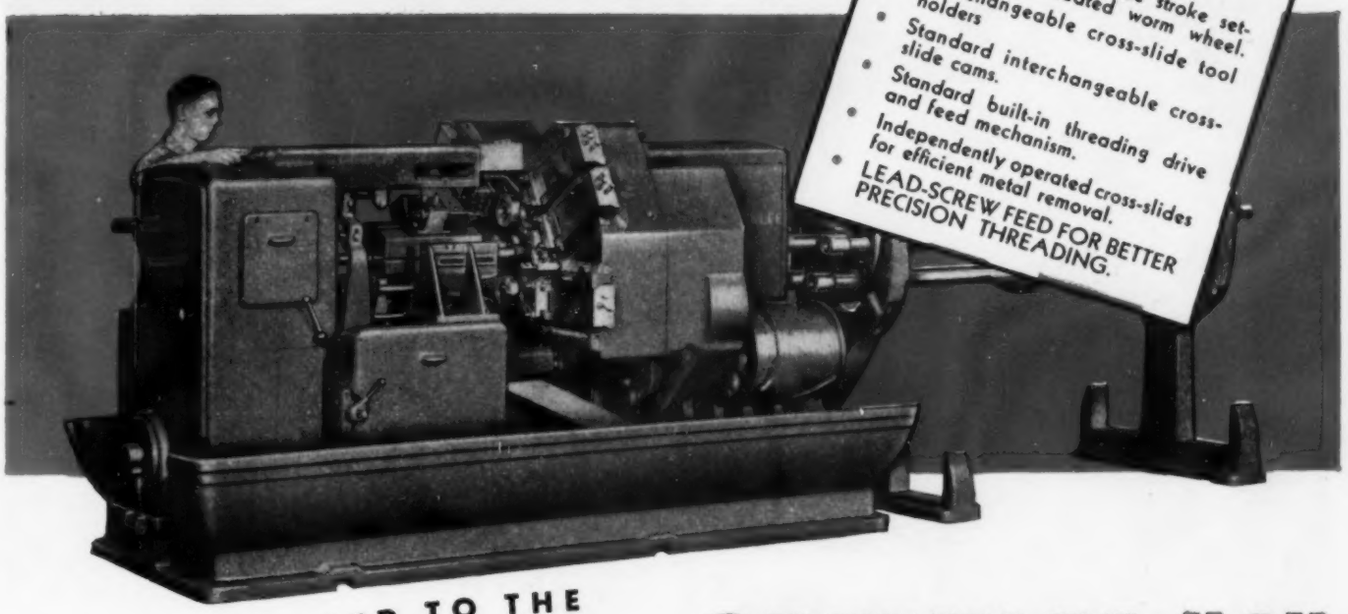
The experience of a foreman in the grinding department of a huge plant is typical. He had been trying to take a .0001" cut off Airdie steel, Rockwell 68. The wheel he was using was getting nowhere. The Robertson sales-engineer put on a Cool-Cut Wheel and said, "Take off .020" depth, with .020" cross-feed." The foreman tried it, and it worked! The Cool-Cut Wheel took the metal off without heating the work and with no measurable wheel loss.

Yes, Robertson Wheels have successfully demonstrated their ability to increase production and give you a substantial bonus in decreased power-costs. If you would like to know more about this revolutionary new wheel, send for your free copy of the pocket booklet "How to Buy Production Time."

ROBERTSON COOL-CUT

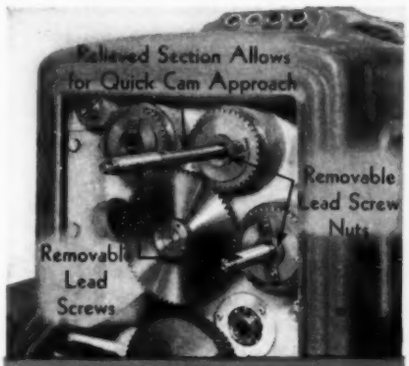
ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY
Manufacturers of Vitrified-Bonded Grinding Wheels
Mounted Wheels • Segments

LEAD-SCREW FEED FOR *Better* PRECISION THREADING....

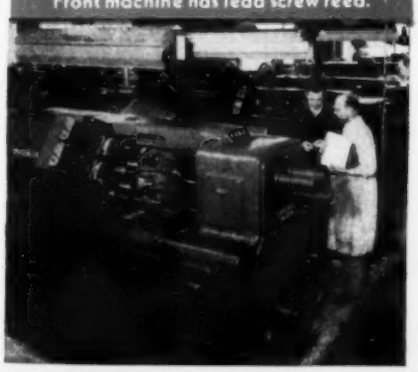

• Wide open tooling area.
• Quick main tool-slide stroke settings on graduated worm wheel.
• Interchangeable cross-slide tool holders
• Standard interchangeable cross-slide cams.
• Standard built-in threading drive and feed mechanism.
• Independently operated cross-slides for efficient metal removal.
• LEAD-SCREW FEED FOR BETTER PRECISION THREADING.

HAS BEEN ADDED TO THE OUTSTANDING FEATURES OF GREENLEE "6"

AUTOMATIC SCREW MACHINES



(Above) End gear box cover removed, showing lead screw threading spindle drive shafts in 4th and 5th positions. (Below) These Greenlees produce industrial hose couplings and fittings at Anchor Coupling Co., Libertyville, Ill. Front machine has lead screw feed.



Operators on Greenlees have plenty of elbow room to work in the tooling area, for changing tools, making adjustments, checking work during set-up, etc.

Change-overs are speeded by a quick and easy adjustment for the main tool-slide stroke. No cams to struggle with— just a simple setting to make on a graduated worm wheel.

Tool-holders for the cross-slides are interchangeable so any tool fits all cavities.

Feed-setting on cross slides is fast and simple, using standardized and interchangeable cams — any of which will fit any slide.

Cam-controlled threading feed is a *standard built-in feature* on Greenlees, including built-in drive sleeves in four positions.

Cross-slides are independently operated — permitting the set-up man to select from a wide variety of tooling arrangements and make adjustments as necessary.

AND NOW an extra feature to meet modern production demands — LEAD SCREW FEED for extra power and precision on threading operations. The mechanism can be added to most existing Greenlees at low cost.

FREE LITERATURE

Learn more about these and many other valuable Greenlee features that make this machine "The Operator's Favorite". Write today for bulletins — ask for Screw Machine Literature.

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO., 1722 MASON AVE., ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

GROUND FROM THE SOLID
BATH
JOHN BATH CO.

IT TAKES SOMETHING EXTRA TO BE A *Specialist!*

No one questions the traditional skill of the glass blower. His "know-how" . . . like that of the precision machinist who fashions BATH taps, is the result of special aptitude and years of exacting experience.

BATH ground thread taps are toughened by hardening and tempering — then ground from the solid to exact specifications for stock and special sizes. This uniform hardness of BATH taps insures a refined cutting edge, accurate thread form, lead and angle. You'll find extra long wear in all taps with the name BATH on the shank — they're made by master craftsmen! See your BATH representative or write direct about your tap problems.

(Transportation is paid to your plant on all Bath products)

JOHN BATH CO. INCORPORATED

22 Grafton Street
WORCESTER 8, MASS.

GROUND THREAD TAPS • PLUG AND RING THREAD GAGES • INTERNAL MICROMETERS

production sharpening • precision sharpening

IT'S ALL THE SAME ON THE 6-5

The ease with which precision sharpening is accomplished on the No. 6-5 Hydraulic Hob Sharpening Machine, is demonstrated in this actual job record.

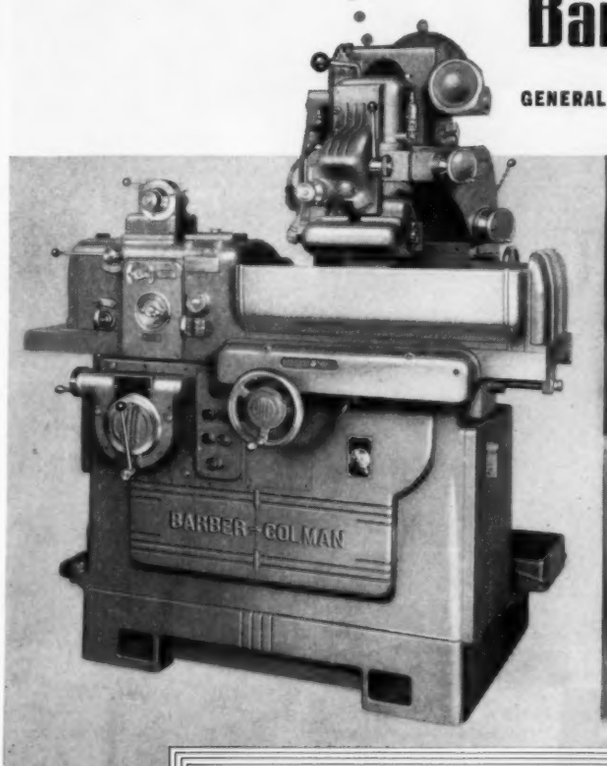
This application shows the accuracy obtained when sharpening large diameter, taper root spline hobs. These hobs are 5" in diameter, with decreased cutting depth from the large to the small end for hobbing a tapered root diameter on spline shafts, and are made with 26 teeth to produce excellent finish with a fine feed mark pattern.

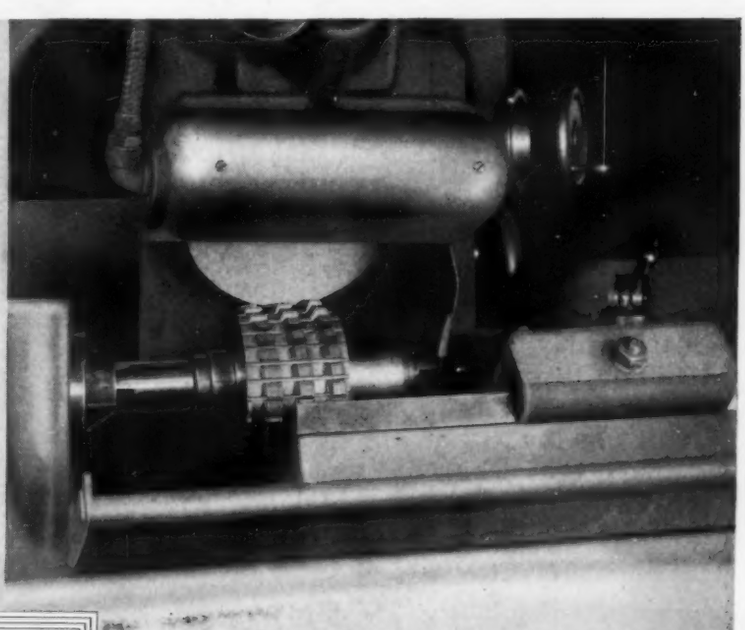
When sharpening with ordinary methods, deflection of the wheel sometimes occurs as the wheel pressure against the teeth diminishes toward the shallow depth. This condition is eliminated on the No. 6-5 because of the rigidity built into the wheel head, and the precision control provided over indexing and table travel. Sharpening tolerances maintained on a complete lot of 20 hobs are shown.

Write for complete information on the 6-5 Machine. Ask for Bulletin 3212.

Barber-Colman Company

GENERAL OFFICES AND PLANT 181 LOOMIS ST., ROCKFORD, ILLINOIS, U.S.A.





JOB FACTS

Operation — Face sharpen Taper Root High Speed Steel Spline Hobs to class AA tolerances

Hobs—5" diameter x 3-1/2" face

Gashes—Straight	Cutting Faces—Radial
Depth of Grind—25/64"	Wheel—7" Carborundum
Stock Removed—.010"	Feed per Rev.—.0005"
Wheel RPM—3600	Coolant—Micro-Grind

Accuracy—Adjacent spacing—.0005"
Non-adjacent spacing—.001"
Radial faces—.0003"

BARBER COLMAN — EASIER, MORE ACCURATE HOB SHARPENING...

ANOTHER *Plus* FEATURE . . .

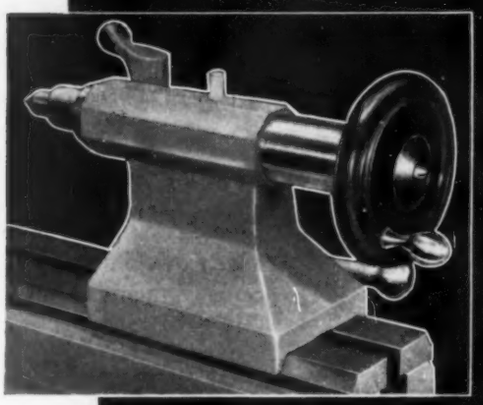
OF THE NEW **RIVETT**
918S PRECISION CABINET LATHE

DOUBLE-BEVEL WAYS AND MAXIMUM BEARING AREA!

See the hardened and precision-ground steel bed with double-bevel ways for alignment. In combination with the wide top surface they provide maximum bearing area for slide rest shoe and tailstock. The self-centering action of the double-bevel ways safeguards tailstock from wearing away from cutting tool out of alignment.

Double-bevel ways assure against the inherent weakness of any type of bed which depends upon front bearing only for alignment. In such construction wear is lateral against a narrow bearing area and away from cutting tool which makes for taper turning between centers. This out of alignment also produces off-center (oversize) drilling and reaming.

On double-bevel ways the tailstock may be operated in conventional fashion, slid at will along the bedways and locked in desired position by slight finger touch on the eccentric binder. Binding force is self-centering and downward against a large bearing area.

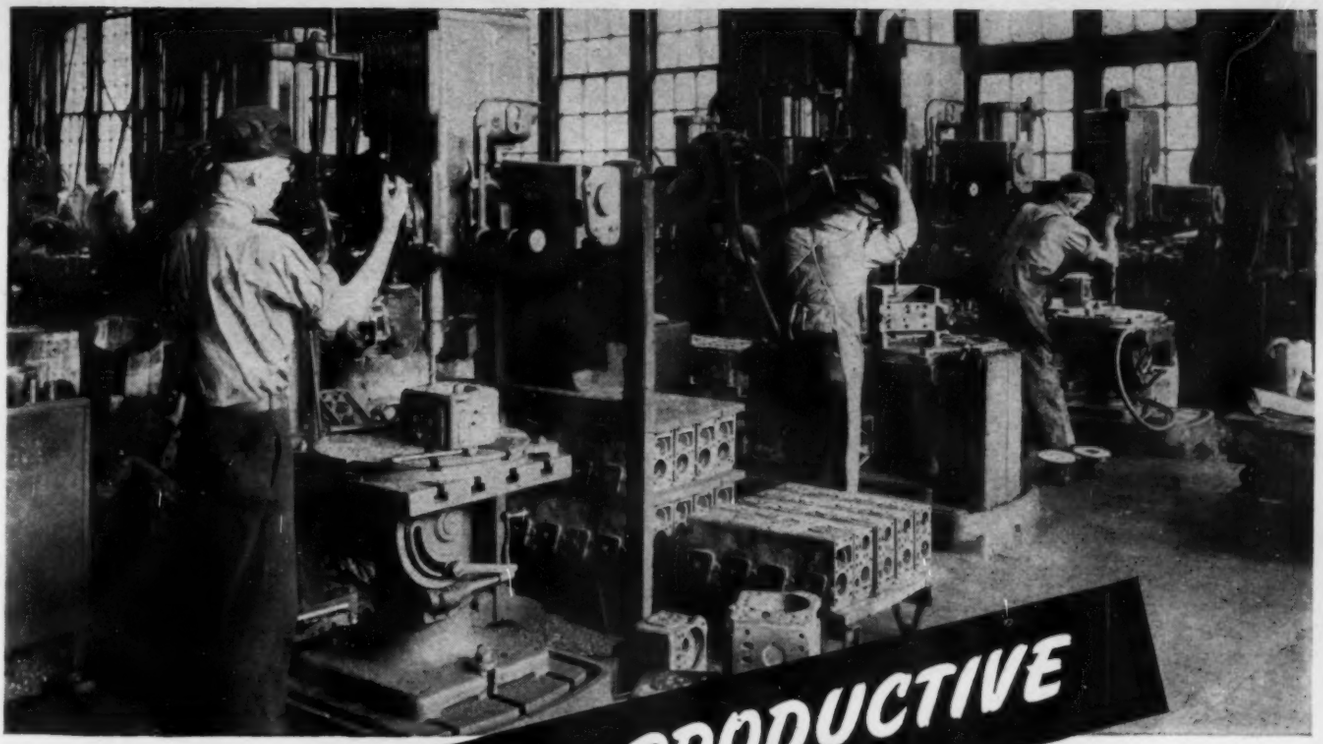


SPINDLE SPEED SELECTION

Correct spindle speed for any operation. Control lever affords any speed from 80 to 3700 r.p.m. Selected speed shows on dial.

RIVETT LATHE & GRINDER, INC.

BRIGHTON · BOSTON
MASS. · U. S. A.

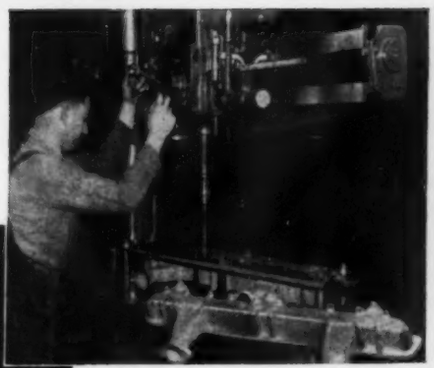


HIGHLY PRODUCTIVE

High speed brought profit on these jobs. These quiet, smooth, Cincinnati Bickford High-Speed Super Service Drills are equipped with modern, easy controls—all centralized on the head, at the operator's hand. They give long, trouble-free performance.

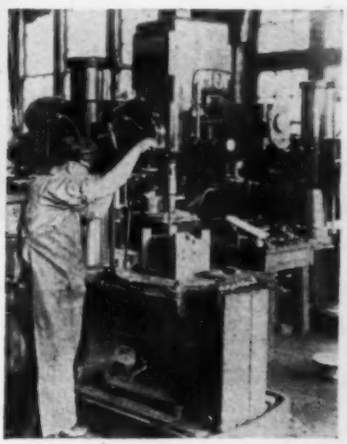
Every operation conveniently controlled—nine spindle speeds controlled by one lever—dials large and easily read—arm swings with a finger-tip ease—automatic lubrication, and many other features to give the greatest ease of performance.

Write for Bulletins R-26A and R-21B.



Due to the construction of this machine, long drills are used with accuracy.

This Super Service Radial reduced the time on this job from thirteen minutes to five minutes.

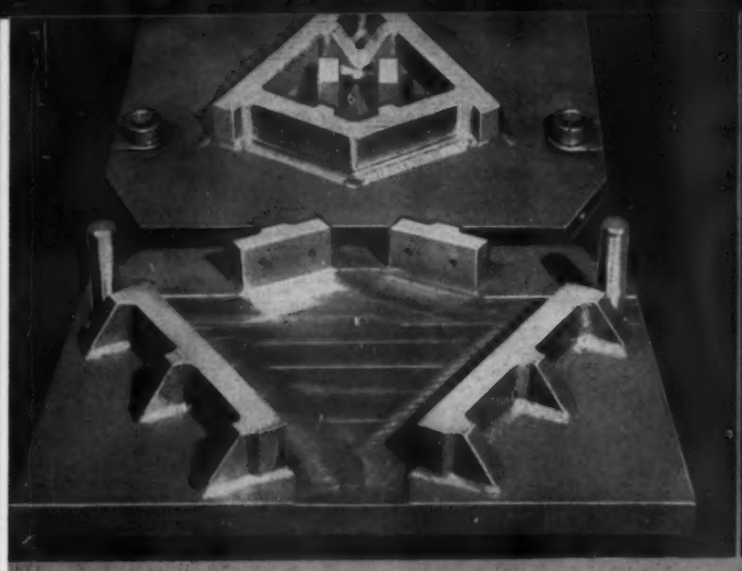


On this job a universal table increases speed of production.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

Equal Efficiency of Every Unit Makes the Balanced Machine

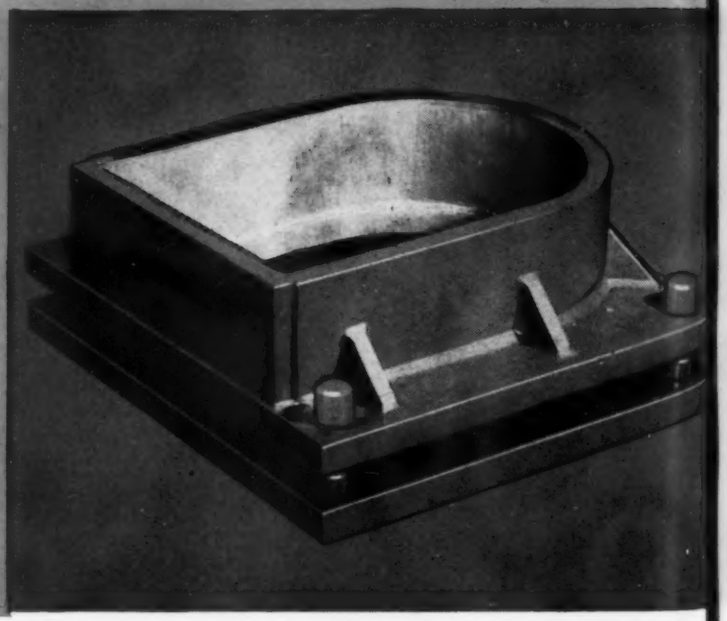
THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



DANLY SPECIAL-PURPOSE DIE SETS

DIFFERENT SIZES
DIFFERENT SHAPES
DIFFERENT PURPOSES

The same DANLY Precision



THE design, shape, size of a die set is determined by its purpose. Many tool designers and engineers have found that only *specially* designed and constructed die sets can do the job efficiently. Torch cut pockets, slots, bored die pockets, planed or milled keyways, drilled knockouts, slug or hold-down holes, welded steel mounting pads—all of these operations and more can be performed at Danly during production of the die set.

This service can be especially valuable to you in the production of large die sets. Additional cutting and welding operations, so easily handled at Danly, may cause difficulty in the die shop or your own tool room where equipment is not specifically suited to large work.

The die sets shown on this page are typical of the kind of work performed in Danly's well-equipped shops. These sets are widely different, but all have the same *Danly Precision*. Freely consult Danly's engineering department for quotations.

DANLY MACHINE SPECIALTIES, INC., 2100 So. 52nd Ave., Chicago 50, Illinois

DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

Spot NEWS OF METALWORKING

The record 796 elections conducted by NLRB in December was a sample of what is coming in 1948. It is estimated that 30,000 union shop polls will be taken this year. Elections also will be held on union representation, including craft units, plant protection and professional employees. NLRB will have 2300 employees by Dec. 1, against 700 under Wagner Act.

Fuel oil shortage has put a deep dent in the business of oil heater manufacturers. Backlog of 12 months' production of one company has shrunk by cancellations so badly in one month that today all firm orders can be filled before March 1.

Polished automobile bumper steel is being roller coated with a plastic skin and then cold formed. The plastic prevents scratching and can be stripped off when the bumper is to be used.

To put all U.S. strategic industries underground would cost $400 billions. That is why extensive underground plants are not being planned, though certain highly critical war items are likely to be given the protection of underground locations.

Britain is reported shifting to Africa the role in the Empire formerly played by India. Factories and industries of all kinds are to be developed not only in South Africa, but in all parts of Africa where the British have a foothold.

> **Since last July Export-Import Bank has loaned $54 million to Italian firms, including $10 million to Fiat for materials and equipment. No disbursements have yet been made in connection with this loan or with credits of $13 million to Austrian companies. Metalworking looms large on both Italian and Austrian lists.**

UAW has charged General Motors with unfair labor practices by offering its employees a group insurance plan without bargaining collectively on the plan. The program, says the UAW, "is designed to deprive the union of the benefit of having its members know that said program was in anywise the result of the activities of the union on their behalf."

One hundred twenty plants will be retained by the services on a standby basis. Another 150 will be leased with provision that they can get back into manufacture of war goods quickly.

Krug's nine-billion-dollar synthetic oil program is no pipe dream. It is the product of military thinking and has wide support in industry—to achieve within 10 years capacity to turn out 2 million barrels a day of liquid fuel from coal, natural gas and shale. First move will be government construction of three 10,000-bbl.-a-day plants, this year or next.

Some 5000 industrial plants already have been allocated to the three services on a voluntary basis for the next emergency. About 11,000 more are in the process of being allocated. All three services—Army, Navy, Air Force—and the companies involved must agree.

More than 100 laborers have been transported from Puerto Rico to the National Tube Co., Lorain, Ohio, under contracts supervised by Puerto Rican labor commissioner under a new law intended to prevent exploitation and to assure normal absorption in the plant and community.

All bodies on the three lines of new Ford cars will be made from different shells, thus giving each car its own individuality. Tooling for this feature alone has cost Ford over $80 millions.

Czechoslovakia is proceeding with plans for making metalworking its most important industry in production and in exports, replacing the Czech textile industry and glass industry.

Gaging Metalworking

Output Stays at Peak

There are no signs immediately ahead that the metalworking industries will relax their record-breaking peacetime production pace. Backlogs, however, are no longer expanding. Instead they are being cut into by the high output and by rigid screening of orders from questionable buyers.

The pile-up of orders in most lines is not too much below the level of a year ago. This means that up to now, the tremendous volume of goods pouring out of metalworking plants has not hurt the chances of production continuing to roll along without any letdown for some time.

More Goods Being Produced

More goods will come out of the metalworking industries this year than last because there is more capacity now than then. The tractor and farm implement industries are prime examples. Both have huge backlogs and will step up output as postwar facilities are completed during 1948. Little is heard about it, but an active gray market exists in farm implements. The demand is so great that new units are being sold in some cases at astonishing premiums above the regular list prices.

More Steel To Be Available

There is likely to be more steel this year than recent reports have indicated. To begin with, ingot output promises to be 2 to 5 million tons more than last year. Steel raw material capacity, in fact, has gone up all along the line.

▶ Coke oven and blast furnace capacities have risen. With more coking coal, there will be more pig iron. The scrap outlook, too, is better than it was a year ago.

Steel Tonnage May Be Up 10%

Total of finished steel coming off the mills in 1948 may well go over the wartime peak of 63.2 million tons in 1944. A sizable gain in ingot production might be enough to set up new records for tons of finished product.

▶ Metalworking stands to gain far more, however, than the anticipated expansion in ingot capacity. Tonnage delivered to consumers may be as much as 10% more than last year. Here's why:

1. Exports won't be more than in '47 even if ERP is not pared down.
2. Inventories are not being added to as rapidly as they were, thus releasing more current steel output for immediate use.
3. Heavy industrial construction, which uses a lot of steel, probably will slope off. The tonnage thus saved will be diverted to other classes of users.

Sheet and Strip Users To Benefit

Sheet and strip steel consumers are likely to benefit more than the average steel user this year. Prospects are that flat-rolled capacity will be augmented more than 10%, and mills will tend to divert more ingot tonnage to the profitable sheet and strip categories.

▶ At the moment, flat-rolled steel in particular is as tight as ever. Many users, desperate for tonnage to keep their plants operating, are still resorting to the gray market and are paying fantastic prices to help meet their needs.

Metalworking Can Take More Steel

Metalworking industries, solely on the basis of capacity, will be able to absorb larger steel supplies. That fact is driven home by the results of the recent McGraw-Hill survey which showed a productive capacity in metalworking which, by the end of 1948, will be two-thirds greater than in 1939.

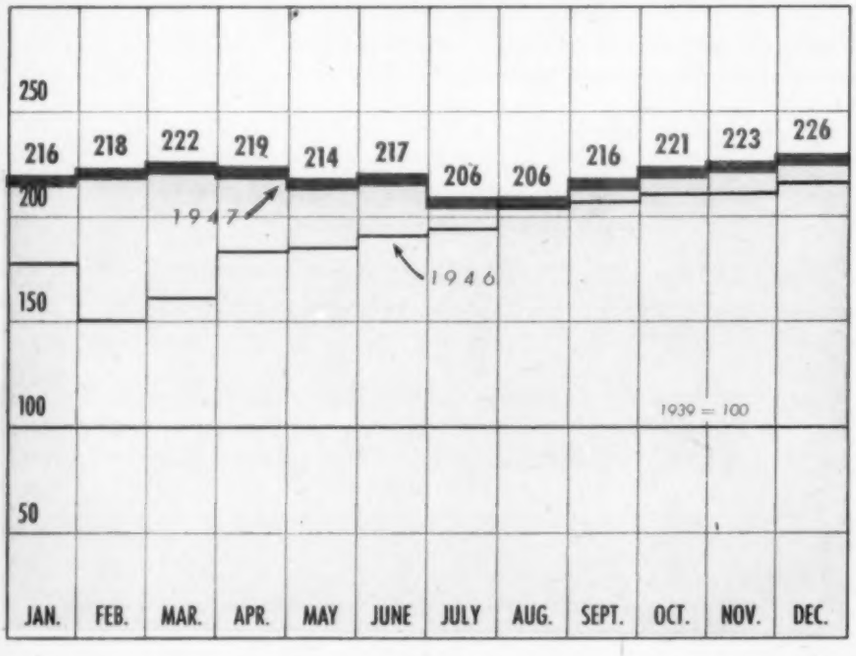
▶ Metal producers, in contrast, are lifting their capacities far less. If metalworking firms can get orders to keep going full tilt, they may have trouble securing enough materials. A metalworking shift toward products using more manhours per ton of metal may be a balancing factor.

Machine Tool Exports a Problem

The big worry among machine tool builders is what will happen to export business. Up to now, it has been over one-fourth of the industry's total shipments since the war's end. It has been steadily shrinking, however, during the past year as dollar resources abroad dwindled and import licenses were harder to get.

There still is no provision in the Marshall program for machine tools and other production equipment. European nations are supposed to acquire such machinery by means of repayable loans through U.S. agencies like the Export-Import Bank. The bank already has made industrial loans to Italy and Austria, but

American Machinist METALWORKING INDEX



not on a scale comparable with overall European requirements.

Back-Up of Orders in France

In France alone, the back-up of orders for U.S. machine tools for which the government cannot allocate dollars amounts to $25 millions. The same problem, in varying degree, confronts American machine tool builders in almost all European countries.

It is possible that the administrator of ERP, after the program gets going, may designate a specified sum for machine tools and similar equipment and disburse it through the Export-Import Bank. Meanwhile, the new controls over exports to be enforced beginning March 1 make it even tougher for machine tool companies to do business abroad.

It is anybody's guess as to the volume of machine tool orders coming to domestic builders from export sources this year. The situation is not a happy one just now.

Industry Expects $350 Million

The uncertainty about foreign sales makes the machine tool industry less sure of what its overall operations will be this year. Domestic demand has been reasonably good, however, and industry leaders continue to expect shipments for 1948 to be around $350 million. Much of the $50 million gain over 1947 will be represented by price increases.

▸ Automobile companies, tractor and farm implement makers and electrical goods manufacturers are currently the best customers for machine tools.

Cutting Tool Demand Fair

Cutting tool makers say that their sales are only fair. Users now have about all the inventory that they want, and new orders are pretty well gaged by production replacement needs.

▸ Backlogs have shrunk substantially in the past year. Current operations reflect the ups and downs in consumer plants far more closely than at any time since prewar days.

Business Brisk in Electrical Goods

Business continues excellent in the heavy electrical goods field. Turbines and transformers are being produced at full capacity with no visible dent being made in backlogs. It will take several years for manufacturers to catch up with the demand for power-generating machinery.

▸ In electric appliances, output has increased so markedly that voluntary allocations of some items to dealers may disappear in the last half of 1948. Products such as refrigerators, irons, toasters, ranges, clocks and washing machines are being allocated at present.

▸ Refrigerators, for one, are expected to be made in considerably larger numbers this year than last, because of new postwar capacity coming in and more steel tonnage available. A leading manufacturer thinks its production in '48 will be up 40% from last year.

▸ One indication that the supply is increasing in the electrical appliance field is that the customer is price conscious.

Television Takes Spurt

Deliveries are much better on electric motors from 1 to 15 hp. Some companies can make immediate shipments out of stock, in sharp contrast with the tightness only six months ago. Large motors are quoted at 16 weeks and upward.

▸ The situation in fractional horsepower motors also is easing. These motors are coming off assembly lines at a record-breaking clip, far above the volume turned out prior to the war.

▸ Television will take a terrific spurt this year. This year's production is roughly estimated at 600,000 sets, or four times the 150,000 sets made during 1947.

Weather Hampers Auto Assemblies

Automobile and truck assemblies have been running well over 100,000 units a week. The zero weather and fuel shortage, however, has disrupted production. Some manufacturing units have had to suspend work for as long as a week at a time. Nevertheless, the industry is heading toward an output for 1948 in excess of the 1947 total.

▸ There is growing evidence that motor car makers may have to begin to sell sooner than they thought. High-priced car backlogs have been whittled down and in some districts have almost disappeared. The used car market has begun to lose its zip, and in many cities is spotty. Some manufacturers are beginning to think about selling again.

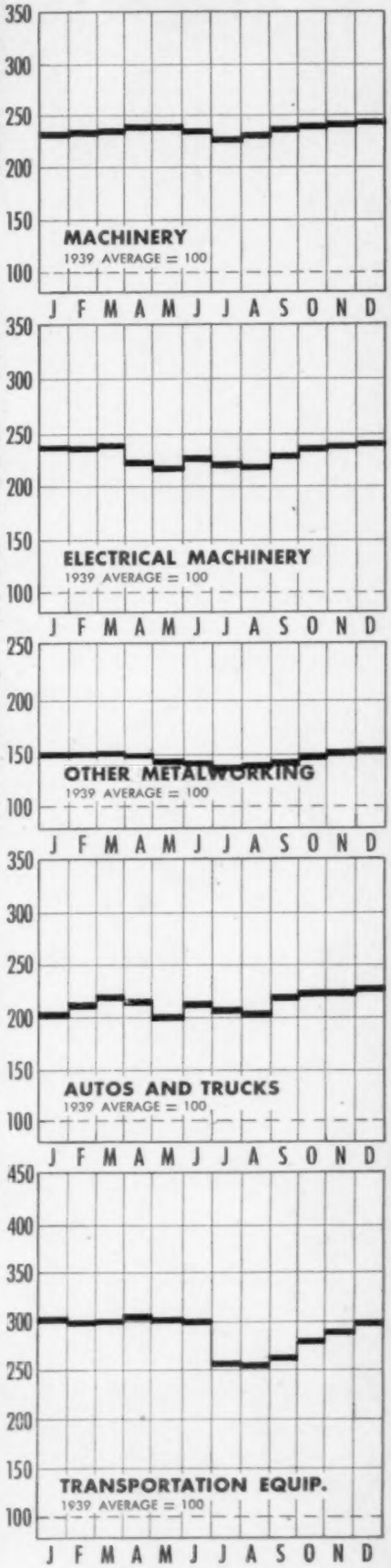
▸ Almost 11% of the 1947 automobile production went abroad. The breakdown is interesting, because it shows that trucks and coaches comprised close to one-half (251,482 units) the total.

Chain In Short Supply

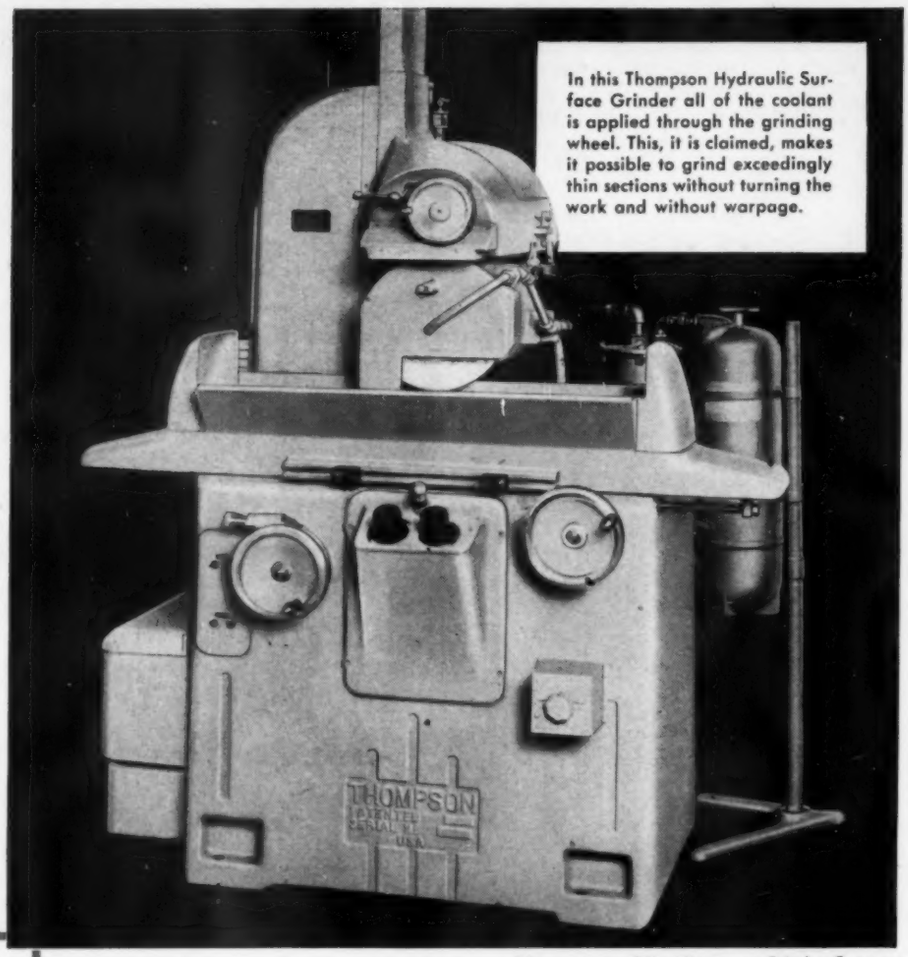
Chain happens to be one of the very short metalworking items. One chain maker, typical of the industry, is completely booked through this year and well into 1949. He cannot make roller chain fast enough. Motorcycle and bicycle chain sizes are especially short. In numerous cases, the manufacturer is agreeing to deliver only one-fifth of the quantity of chain asked for by customers.

PRODUCTION INDEXES

FOR THE FIVE PRINCIPAL DIVISIONS OF METALWORKING



CAN HYDRAULIC SYSTEMS BE KEPT CLEAN?



In this Thompson Hydraulic Surface Grinder all of the coolant is applied through the grinding wheel. This, it is claimed, makes it possible to grind exceedingly thin sections without turning the work and without warpage.

Photo courtesy The Thompson Grinder Company

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When you use oils especially made to prevent rust, sludge and foam — *Texaco Regal Oils* (R&O).

YOU benefit in many ways when you use *Texaco Regal Oils (R & O)* in your hydraulic systems. These fine, turbine-grade oils are especially inhibited against rust and oxidation, and processed to prevent foaming. Thus, they virtually eliminate the major causes of hydraulic system stoppages.

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Operators everywhere are enthusiastic about the exceptional results obtained with *Texaco Regal Oils (R & O)*. Leading hydraulic equipment manufacturers recommend these famous oils — and many ship their units already filled with them.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

To Help ERP Do a Job

Congress will make a grave error if it leaves machine tools out of the European Recovery Program.

The program isn't solely for relief. It also is intended to help rebuild Europe's industries.

Before Europe can produce more of her own requirements, she must rehabilitate her shops and factories, and erect new ones. All of them must be equipped with machine tools.

Where are these machine tools coming from? Not from Europe, both because her own machine tool industries are inadequate and because Germany's once powerful machine tool industry is prostrate.

Not from Britain, because her machinery builders are booked from one to two years ahead.

Not from us, because European countries don't have the necessary dollars to pay us.

Yet why not from us, under ERP? An outlay of $100 millions for machine tool purchases will do more to put Europe on its industrial feet again than the outpouring of billions for many other commodities.

Machine tools, unlike a lot of things sought under ERP, are not in short supply. America has ample capacity to build them without depriving the domestic economy of its full share of equipment.

As matters stand, any financing of machine tools for Europe will be done by government agencies such as the Export-Import Bank. And Export-Import Bank officials approach the subject on a hard-and-fast repayable-loan basis, unlike the general policy of ERP. If this "banker" attitude is to prevail, Europe will wait a long time to get many U.S. machine tools.

Europe must have food, and clothing, and fuel, and road construction machinery, and farm implements, and a lot of other things to get started back to a decent standard of living.

But let's not lose sight of the fact that the sooner she can produce many of these things herself, the better off she will be and the more quickly we can stop financing her with our tax money.

Before she can produce, however, she must have machine tools. That is why ERP is not complete without machine tools.

Is there some quick and effective way of sinking that fundamental fact into the minds of those directing ERP?

Burnham Finney

EDITOR

DRAWING

ANOTHER JOB OCCASIONALLY DONE ON CINCINNATI PRESS BRAKES

96" frame, 3" to 7" wide, 2½" flange, of 12-gauge high tensile steel.

Standard Cincinnati Press Brakes are furnished with die surfaces from 4 feet to 30 feet.

Drawing is unusual on a Press Brake, but is done successfully within reasonable limits.

This Press Brake brought low cost and clean-cut production in the manufacturing of these trailer frames.

The three advantages—low investment—accurate performance—rapid rate of production—all contribute to high return on investment.

The many functions and the economical applications of Cincinnati Press Brakes may bring steady profits in your shop.

Write for Catalog B-2, which illustrates many uses, as well as the extensive line of Cincinnati Press Brakes.

THE CINCINNATI SHAPER CO.

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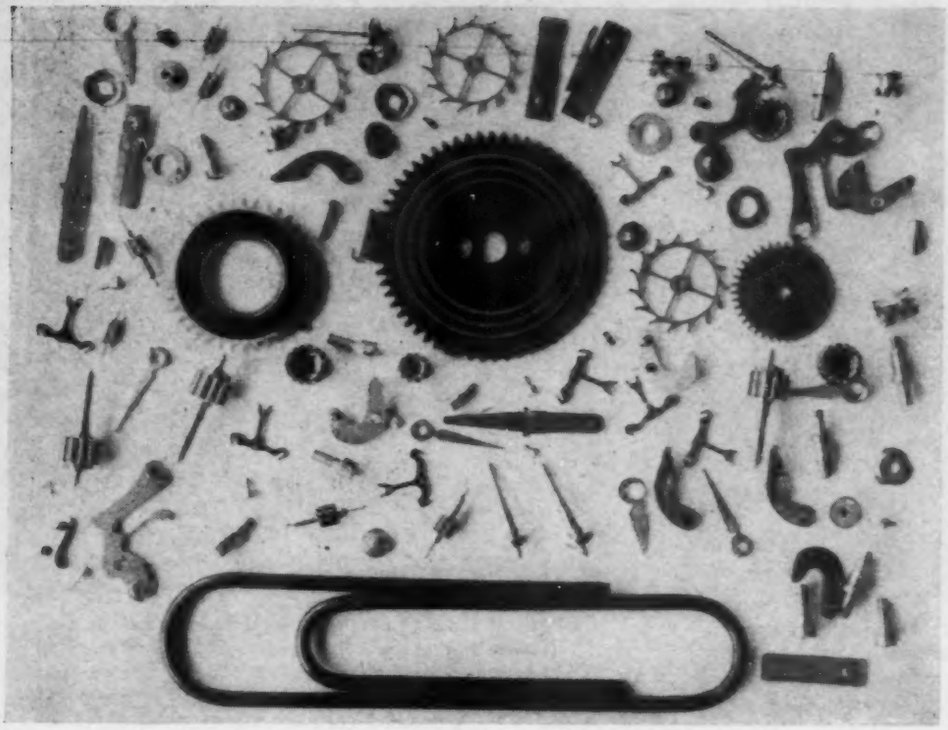


Watch-part requisites of no discoloration, carburization or decarburization and definite hardness properties for wear resistance make for tricky heat-treating problems because of extreme smallness and sharp detail of parts shown in comparison to 1¾-in. long paper clip

Bright Hardening and Tempering Tiny Parts...I

BY HARRY L. HOVIS, WORKS CHEMIST, AND A. W. MARKS, HEAT-TREATING FOREMAN, HAMILTON WATCH COMPANY

Quenching-oil and atmosphere investigation led to modification of heat-treating process and bright, clean work surfaces

PRECISION-INSTRUMENT parts, such as for a watch, require the utmost in careful control of heat-treating processes. Machining of parts to ±0.0001 in., and in many cases with no stock removal after heat treating, permits no decarburization, carburization or oxidation during treatment. Then too, the positive physical requirements for small pinions require the most exacting treatment.

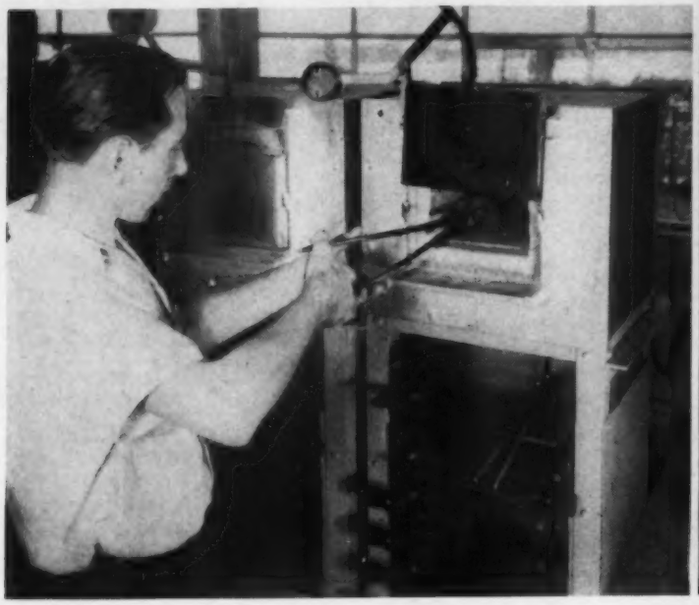
Watch parts, to meet the standards established by our technical departments and to maintain our rigid timing specifications, must be sufficiently hard to be wear resistant and capable of being highly polished.

Rockwell hardness must be maintained in most cases within a two- to four-point range in the C scale, and parts must be capable of bending several degrees without taking a definite set. In other words, a pinion or staff that breaks without setting is desirable, because a watch cannot maintain accuracy with pinions not absolutely true.

To maintain uniform results from lot to lot, it has been found necessary to control part stock closely with respect to composition, structure, surface and hardenability characteristics. Definite hardenability specifications have been established over a period of years. Actual heat-treating tests are made on each shipment to determine its response to treatment, and the resultant fracture and fineness of grain are carefully studied.

Parts are taken from each lot of work as hardened and are checked against the standard established for the particular shipment from which they were made. Each lot of work is identified with a number corresponding to that placed on different shipments of material as received.

The method employed in the past



OLD **Pack - hardening method** meant packing watch parts in charcoal, heating in a muffle furnace, quenching in oil and separating small parts from the charcoal. Result: costly, slow and inconsistent process

NEW **Bright-hardening method** requires no packing as parts are placed on polished nichrome hearth plate which is tilted to quench parts quickly. Result: reduced time and cost, greater production, no cleaning needed

for hardening of parts required packing the work in a cylindrical nichrome container and producing an atmosphere by packing parts with maple or willow charcoal. After bringing the entire mass to the required hardening temperature in a muffle-type furnace, parts were quenched into oil along with the charcoal.

Quenching was followed by degreasing to remove the oil, and parts, after drying, were separated from the charcoal. This process had the following disadvantages:

1. Although parts were not oxidized or deeply discolored, they did not have a bright metallic luster and were sometimes spotted and pitted from below-standard charcoal.

2. Heating of parts packed with charcoal in containers resulted in a slow rate of heat transfer, making it necessary to wait until the container was heated through. The proper rate of heat and the time required to produce the desired physicals definitely required an operator who was experienced and thoroughly familiar with the pack-hardening method.

3. Quenching of parts packed in this manner also required a skilled operator. It was done by removing the container lid with tongs and pouring the parts into a sieve immersed in the oil. It was necessary to keep the container close to the oil to prevent pre-cooling and oxidation. Immediate agitation of parts was also important while quenching.

4. Quenching of charcoal along with the parts contaminated the oil. After removal of oil by degreasing, parts had to be separated from the charcoal. This was extremely difficult because of their small size.

5. In many cases, cleaning after hardening was necessary to produce parts sufficiently clean for acceptance by inspection and manufacturing departments.

Investigation Demanded

Because of the many disadvantages of this procedure, some investigation was made as far back as 1934 on equipment which would be capable of producing bright-hardened parts by means of a controlled atmosphere. We were not successful in purchasing an acceptable unit, so this work was delayed until 1939.

At that time parts were forwarded to several companies for bright hardening. Results were considered fairly satisfactory, but we were not yet convinced.

During the war, we were required to manufacture larger instruments, such as the marine chronometer. Heat treatment of larger parts introduced a further problem. Also, we were unable to obtain uniformly satisfactory materials, such as charcoal, with the result that parts were obtained that were difficult to clean and could be used only with chemical cleaning and mechanical operations—brushing and tumbling.

To take care of the special cleaning required, our laboratory alone employed four persons full time to clean work with inhibited acids between hardening and drawing operations. Usually the work was cleaned again after drawing.

The manufacturing departments also found it necessary to tumble some parts as long as 15 to 20 hr., and on other parts individual mechanical brushing was established. This not only was costly, but also delayed production.

This condition practically demanded a reinvestigation of bright-hardening equipment, resulting in the purchase of bright-hardening as well as bright-drawing equipment.

Tests were immediately started as soon as the bright-hardening equipment was installed. It was discovered that there was more to bright hardening than purchasing and operating a furnace.

Furnace atmosphere was produced by a generator which burned charcoal. It was felt that this CO atmosphere should be satisfactory without the addition of another gas, because hardening time for such small parts was so short that there should be no carburization or decarburization. This was found to be true by actual study of the structure of hardened parts.

Quench Oil Checked

The quenching oil was a popular commercially available grade and had been used in our previous procedure. Results obtained were fair but not consistently satisfactory with respect to producing bright parts that would require no cleaning after treatment.

As practically all work done by the old pack method had been cleaned prior to delivery to processing departments, a fairly high standard had been established by our inspection and manufacturing departments, particularly with respect to surface discoloration.

This work was done in collaboration with equipment engineers who advised us that we were expecting too much and that the results obtained were generally considered satisfactory by most companies using similar equipment. But we decided to study this problem further to determine if more satisfactory results could be obtained.

Quenching oil was the first problem tackled. Various suppliers of oil were acquainted with our problem and requirements, and tests were conducted on approximately seven different oils but no improvement was noted.

Only two oils showed any merits. Five oils produced parts that were badly discolored and not as satisfactory as the oil then being used. One oil was satisfactory for small parts, but discoloration was obtained on large work. The other oil was satisfactory for several days; parts then gradually became darker in color as quenched.

Filtering of oil did not improve this condition, so it was finally decided to continue to use our original quenching oil. Simultaneously, oil temperature was varied, but this also failed to eliminate work discoloration.

On the basis of these results, some work was started on a study of the atmosphere. The rate of gas flow from the generator was increased and decreased. This was regulated by opening the valve from the blower and recording the rate of air flow into the generator by a flow rotameter.

Air flow was varied from approximately 100 to 300 cfm. This did not seem to affect the results, and the normal flow of air was again set at 250 cfm. Gas flow in the curtain of the furnace was also varied to determine if any air was getting into the furnace when the door was opened. This also did not seem to affect the results.

Various types of charcoal were obtained and burned in the generator. None of these was as satisfactory as the grade recommended for the gas-generator unit. But the furnace operator observed the presence of moisture in the top of the generator in the morning. This led to investigation by our laboratory, which found that the charcoal contained approximately 8 to 10% moisture.

We tried drying the day's requirements of approximately 28 lb.; this improved the results. There was a definite reduction of the dew point to approximately —10C., which is quite low for a unit of this type. On the basis of these findings, an electrically heated drying unit was constructed and is still being used. We have tried on several occasions to use undried charcoal but drying was found to be a contributing factor to successfull bright hardening and was therefore continued.

CO Gas Found Best

This drying operation improved our results, but parts, particularly the larger ones, still showed definite discoloration. Addition of city gas and also propane to the CO generator gas was tried, but results were not as consistent as with straight CO gas. City gas was definitely unsatisfactory.

The generator unit is equipped with a steel wool filter to prevent the transfer of fine charcoal particles from the generator to the furnace. A finer grade of steel wool was found to be more satisfactory.

As no further improvement could be made on the atmosphere investigation, it was thought advisable to return to more thorough study of the quenching oil. A circulator was installed so the oil could be maintained at a lower temperature. This seemed to have some merits, particularly when the temperature was held at about 100 F., and not over 110 F.

The quench oil used in the past for the pack method of hardening seemed to produce the best results but only on small work such as pinions. Larger parts showed definite discoloration which increased as the oil aged.

Straight paraffin oils of varying viscosities were tried, but these broke down after several days and work became badly discolored.

COMPARATIVE FURNACE TIMES
(BRIGHT AND PACK HARDENING)

Item	Quantity in lots	Bright-hardening Time in Hr.	Pack-hardening Time in Hr.
Watch parts	128	2¾	35⅓
Punches & small tools	Misc.	1	3
Drills	3	¼	4
Miscellaneous	1	2½	17½
Miscellaneous	1	1¾	11⅔
Average watch parts	1	⅙	7/12

Savings listed on the last three items are actual furnace times and do not include savings effected by elimination of charcoal packing estimated at approximately 15 min. per lot.

Charcoal for bright-hardening atmosphere is preheated to drive off the 8 to 10% moisture content, reducing dew point and improving part brightness. Oven is electrically heated and large enough to hold day's need of 28 lb.

Lard, sperm and paraffin oils were added in varying percentages to the regular quenching oil. The addition of sperm oil gave satisfactory results, and the work, regardless of size, was really bright and clean. After several days, however, discoloration was again noted.

An increase in sperm oil prolonged the period of satisfactory parts, so it was finally decided to use straight sperm oil. This has been used for approximately two years and is still satisfactory. The only requisite is filtering of the oil every two weeks.

We now obtain bright, clean surfaces on parts, and no cleaning except degreasing to remove quenching oil, is required after hardening. Other advantages of bright hardening are:

1. No packing is required. Clean parts are spread evenly over a polished nichrome hearth plate, resulting in more rapid and direct heating. The hearth plate was polished to a fine surface, because small parts did not easily slide off when it was tilted to quench.

2. The time for heating has been reduced from 15 to 45 min. to from 30 sec. to 5 min.

3. Separation of parts from charcoal and also contamination of the oil have been eliminated.

4. More uniform structure is produced because of more rapid and uniform rate of heat and quench.

5. One bright-hardening furnace has eliminated the use of five hearth-type furnaces.

6. Elimination of cleaning has reduced delay in processing.

7. Production has increased from 600 lots in 1941 to 2,000 lots per mo. in 1947. No increase in personnel was required, although working hours have been reduced from 49 to 40 hr. per wk. Bright hardening of small tools and drills has also been added.

8. The above advantages have effected a saving of approximately 60 man-hours per wk. and also 100 furnace-hours. These savings have been tabulated elsewhere.

Part II will be published in an early issue.

Tips FOR TOP SHOP MEN

220 Your instructions, like school lessons, must be graded to suit your listener. Suit what you say to your hearer, not to your own level.

221 If a man is injured—no matter how trifling the injury may be—see that it is taken care of by a properly trained person. Infection lurks in every corner—and is far worse than the injury in most cases.

222 Nothing is ever "impossible"—it just hasn't been done. Give every idea a chance, no matter what the source—remember that a man too ignorant to know a job is impossible is usually the man who does it. Education is too frequently a process of learning what *can't* be done.

". . . . There's a guy they've never caught off guard on the job. . . ."

HOW TO TURN NON-STANDARD THREADS

BY ERNEST L. SCHLAGE
Director of Research
SCHLAGE LOCK COMPANY

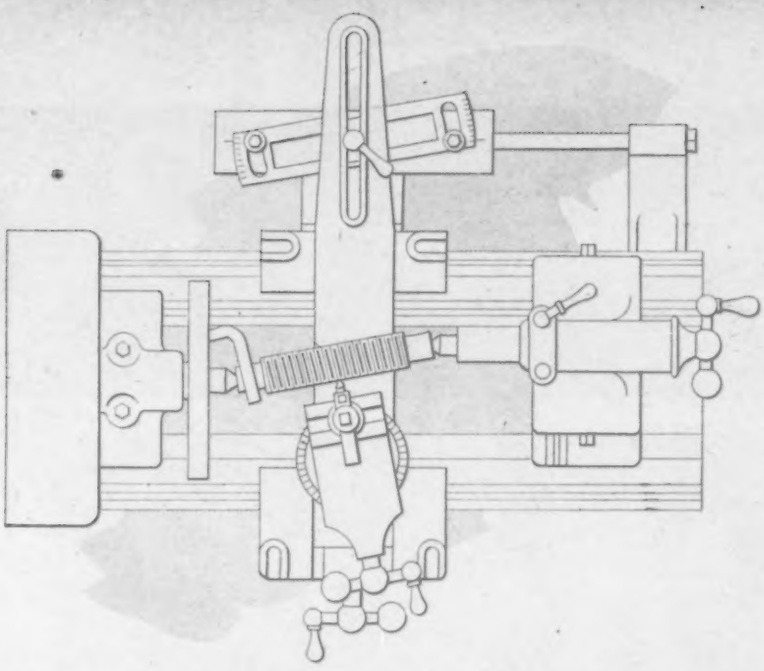


Fig. 1—Tailstock is set over, and taper attachment set to the same angle, so the tool actually travels farther than the carriage

INSTRUMENTS and special-purpose mechanisms sometimes require one or more lead screws having a non-standard or fractional number of threads per inch. An example is a navigation instrument which has a control knob and graduated dial attached to a lead screw. One revolution of the dial corresponds to 1,000 ft. adjustment, and 1 in. of nut travel on the screw corresponds to 3 miles or 15,840 ft. Manifestly, a lead screw having 15.84 tpi. is required.

The machinist faced with cutting such a thread on a commercial lathe will usually attempt to compound the lathe gearing, only to discover he needs one or more special gears, so the job is delayed and cost increased. In many cases, even by compounding four gears, only an approximately correct ratio can be obtained.

By a very simple method, lead screws of unusual or non-standard pitch can be cut exactly on a lathe with taper attachment.

Assume 15.84 tpi. Adjust lathe change gears to produce the next finer standard-pitch thread, in this case 16 tpi. Then set over *both* the taper attachment and the tailstock to the same predetermined angle, Fig. 1, the exact angle to be used being determined by formula. The tool would thus turn a parallel bar of constant diameter. (This step should be checked carefully with a dial indicator in the toolpost and bearing against the surface of the bar. The indicator reading should remain constant as the carriage is moved back and forth.) Cutting of the thread is done by setting the compound rest and tool bit perpendicular to the work surface and following conventional methods.

In our example, the lathe spindle revolves 16 times for each inch of travel of the carriage along the ways, so a 16-tpi. screw would normally be cut. However, as the work is mounted at an angle to the ways, a greater length of bar is exposed to the tool for each inch of its travel along the ways. The 16 threads are thus equally applied over this greater length, resulting in a coarser-pitch thread. The taper attachment merely guides the tool parallel to the work surface.

For the theory, see Fig. 2. *AB* represents the length of a section of the lead screw to be threaded. *AC* is the corresponding length parallel to the lathe axis. The number of threads in any section of a screw equals the number of threads per inch multiplied by the length of the section. As the number of threads in sections *AB* and *AC* are equal, we may write the equation:

$$AB \times \textit{Work tpi.} = AC \times \textit{Lathe tpi.}$$

or

$$\frac{AC}{AB} = \frac{\textit{Work tpi.}}{\textit{Lathe tpi.}}$$

Since $\cos T = \frac{AC}{AB}$

We obtain by substitution

$$\cos T = \frac{\textit{Work tpi.}}{\textit{Lathe tpi.}}$$

Applying this formula:

$$\cos T = \frac{15.84}{16} = 0.99000$$

Therefore $T = 8° 6\frac{1}{2}'$

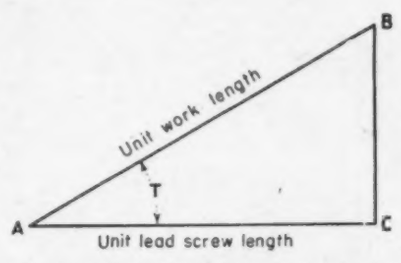


Fig. 2—Obviously, *AB* is longer than *AC*. Thus when the lead screw moves the carriage distance *AC*, the toolbit moves distance *AB*. This spreads the preset number of threads over a greater length, ratio depending on *T*

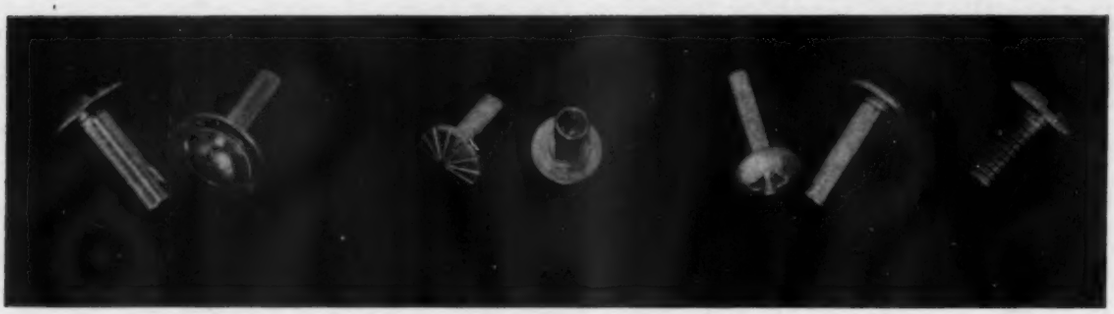
Most taper attachments are graduated to indicate the total included angle of taper; therefore, twice the value of *T* should be used when the attachment is set.

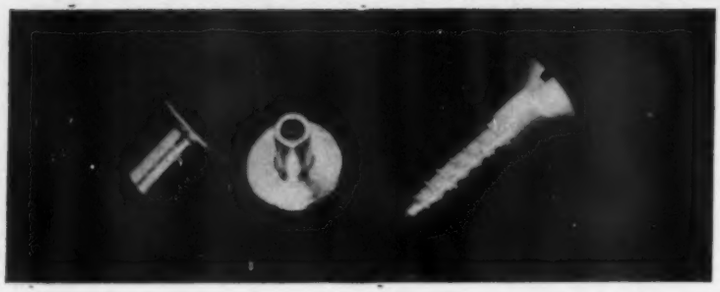
If the taper in "inches per foot" is desired, use this formula:

Taper (in./ft.) = 24 *tan T*

The amount that the tailstock should be set over is equal to the length of the work between centers, multiplied by tangent *T*.

If the bar in our example is 12 in. long between centers, the taper attachment should be adjusted to read $2T = 16° 13'$ included angle or $24 \times \tan 8° 6\frac{1}{2}' = 3.42$ in. of taper per foot, and the tailstock should be offset approximately $12 \times \tan 8° 6\frac{1}{2}' = 1.71$ in.





Washer-head screws, extruded tubular rivets, Phillips recessed, truss head and binding-head screws, shown in upper photo, are among the difficult items fabricated from brass heading and extruding temper stock. Wood screws and drilled tubular rivets (left) are produced from brass-heading and machining-temper material

WIRE, MACHINES AND PROCESSES MEAN

BETTER COLD HEADED BRASS

BY WALTER D. FRANCE

Supervisor Technical Service, Devel. Dept.
SCOVILL MFG. COMPANY

Radical changes in design put more importance on composition, microstructure, temper, surface of material for best production

WOOD SCREWS, machine screws, pins and rivets—some of the products made by cold heading of brass wire— are so common to everyone and so relatively small in size that little attention is given to developments in the intricate heading machines, tools and brass wire to fabricate such parts.

In the early manufacture of screws, production rates of 50 parts per minute were considered good. Production rates of 250 per minute are common today.

Over the years, the designs of many types of items have changed, the most noteworthy being:

1. Introduction of recessed-head screws.
2. Extruded tubular rivets.
3. Struck-slot screws.

Screws having heads three to four times the shank diameter.

The increased rates of production and fabrication of parts having radical design changes require brass wire with excellent cold-heading characteristics which must be in step with advances made in tool design and types of tool steel.

Study of the pertinent wire properties has resulted in the isolation of four fundamental factors:

1. Composition
2. Microstructure
3. Temper
4. Surface

If the coil of brass wire is processed to have the correct inherent fundamental factors, it can be used to fabricate the most difficult cold-heading jobs, provided the tools are properly designed and adjusted.

Some cold-headed parts in the "hard-to-make" class—i.e., a recessed trusshead screw—can only be fabricated economically when all of the above four factors are present. By analyzing the factors individually, the importance of each is clarified.

During the Civil War period, manufacturers of cold-headed parts, the most common of which were wood screws and round-head rivets, produced brass parts almost exclusively from yellow-brass wire. This wire was processed at first by slitting flat metal on a bull slitter, and then redrawing to round wire. About 1900, the process of rod rolling and subsequent drawing to size was used to produce wire for cold-heading. Because the production of screws and rivets on a large scale was relatively new and difficulties in cold-heading hard-drawn tempers were encountered, it was realized early that 70-30 (70% copper and 30% zinc) yellow brass produced the best products.

Particular attention was paid to the composition and control of impurities such as lead by the use of high-grade zinc. After years of use, two common yellow-brass alloys for cold-heading were recognized: screw brass, 63%, and cartridge brass, 70%. These alloys were covered in early ASTM Spec-

ifications and still stand, as in the latest ASTM Specification B134-47 Alloys Nos. 6 and 8.

The important fact to note from this historical review is that the composition of the alloy for more difficult jobs included a high copper content and a relatively low percentage of allowable impurities. Reference to the copper-zinc constitutional diagram shows conclusively that a low-copper-content alloy allows the presence of the brittle, hard Beta phase which reduces ductility and increases abrasion resistance of the alloy. Also, the lack of control of the impurities, lead and iron, in the wire to be used for cold-heading, is very detrimental because of the noticeable effect in lowering the flow characteristics and ductility of the wire.

It was also recognized in the early days that when very difficult jobs were fabricated, better results could be obtained with red brasses. However, the use of these alloys was not economically feasible. Furthermore, the fabrication of wire by rod rolling introduced the possibility of rolling-in seams and slivers on the wire that caused serious heading difficulties. In order to produce a cold-heading wire of high copper content, high purity, good surface and with freedom from the brittle Beta stage, Scovill devoted its efforts to the development and production of cartridge brass, 70%, by the hot extrusion process.

Microstructure

As previously stated, wire processed from cartridge brass is free of Beta. Microstructures illustrating the possible structure of screw wire, 63%, compared to cartridge brass, is shown in the accompanying photographs.

In the microstructure of screw brass, the elongated light-colored stringers of the Beta phase are hard and brittle.

It also should be noted that one of the primary factors in the production of "hard-to-make" cold-headed parts is a wire with structure made up of uniform Alpha equiaxed crystals having a nominal grain size of 0.050 mm. Special annealing procedures have been set up to insure a closely controlled grain size at all stages in the production of the wire. The resulting grain size gives a smooth surface on the cold-headed part, thereby eliminating rough "orange-peel" effect and helping to control spreading in the coning punch.

Temper

A survey of many cold-headed parts has indicated that two drawn tempers were necessary to satisfy the requirements for fabricating the many types of brass screws and rivets. The two standard controlled tempers which most satisfactorily meet all the requirements of cold-heading are identified as:

1. Heading and extruding.
2. Heading and machining (drilling).

The heading and extruding temper, which has a tensile strength of approx. 55,000 psi., makes possible easy cold-heading to over three times the shank diameter and extruding up to 40%. Products from this temper material include Phillips recessed truss head, washer-head screws, binding-head screws and extruded tubular rivets.

The heading and machining temper, which has a tensile strength of approx. 70,000 psi., has been successfully used to make such products as wood screws and drilled tubular rivets. It has been fairly well established that drawn tempers are superior to annealed tempers, because they avoid sizing which may result in excessive tool wear and give a much cleaner cut off.

The heading of a very difficult part from one coil may produce a small percentage of split heads as a result of minor surface conditions on the wire. For best quality cold heading-wire, it can be readily understood that a practically perfect surface is required.

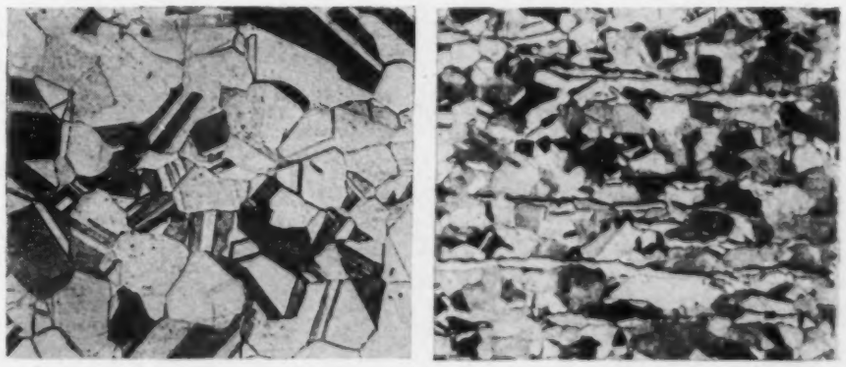
Between anneals, special cleaning procedures result in a clean surface that minimizes surface tearing. For particularly difficult cold-heading jobs, soap-dipped wire is recommended. This surface-treated wire not only serves as a lubricant but also aids in holding the cut in the cold-heading process.

Punch Design Important

As in fabrication of any finished product, tool design and condition are very important. In a double-stroke heading machine, the first punch, known as the coning or pre-head punch, is used for centering and starting the heading operation. This punch is shaped to gather or cone the stock, leaving it tapered at the end and allowing it to head partially next to the die. Design of this coning punch is of utmost importance in cold-heading difficult jobs. For best results with brass wire, it is believed that the flow of the first punch should approach that of the finished shape.

Besides the design and adjustment of the tools, other important factors affecting the quality of the headed parts include:

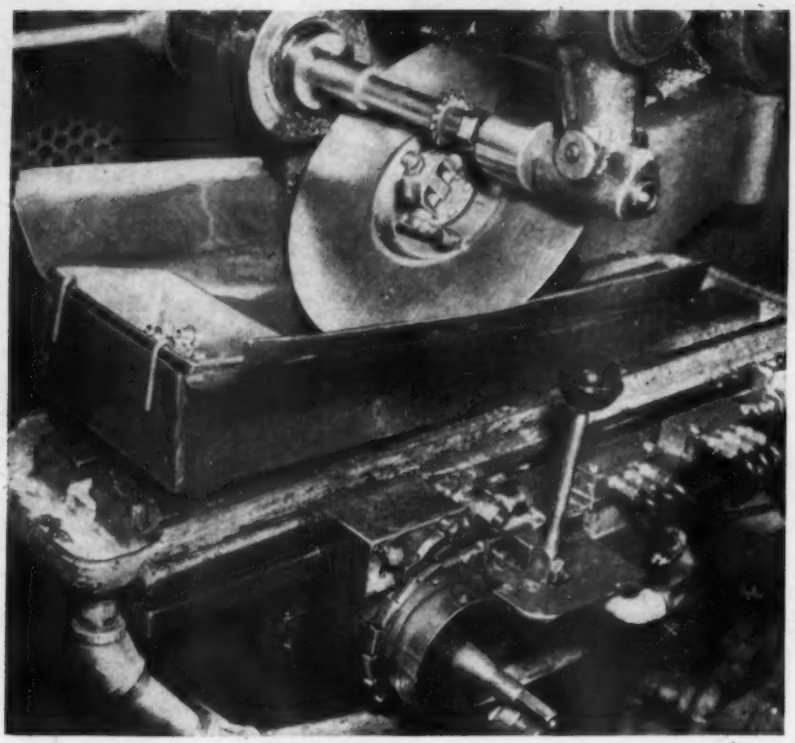
1. Lubricant used
2. Speed of the header
3. Method of cut-off
4. Length of blank
5. Condition of tools



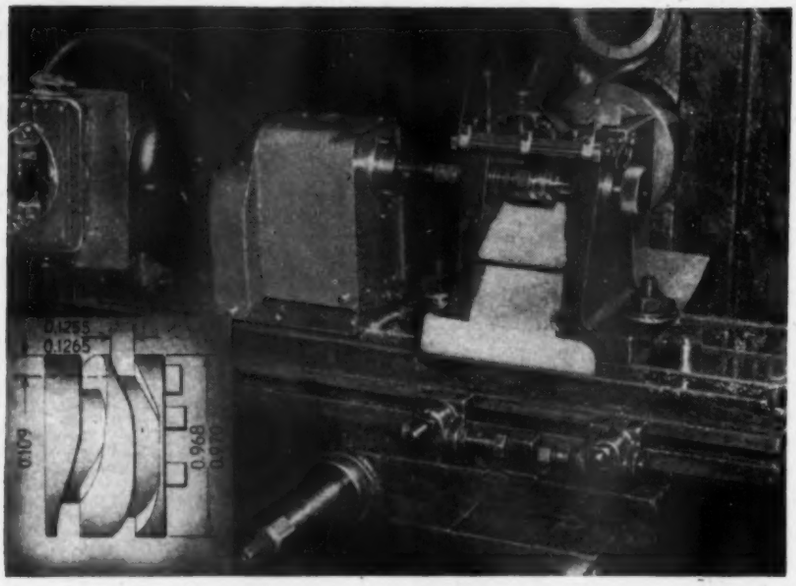
Cartridge Brass, 70%, (left) is made up of uniform Alpha equiaxed crystals having nominal grain size of 0.050mm. In microstructure of screw brass, 63%, (right) the elongated light-colored stringers are the Beta phase which is hard and brittle and is not favorable to cold heading

SHOP SHOTS

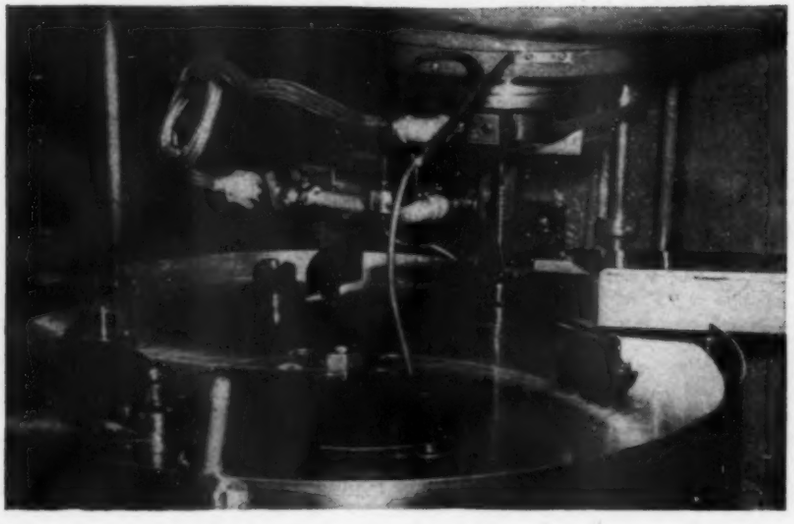
AT FRIDEN



BEVEL-GEAR CUTTING.. U.S. Machine Tool hand mill was made automatic by an air cylinder on the table feed. Feed back and forth is preset by table stops contacting stationary reversing air valves. After each pass, the blank is indexed automatically by a sprocket behind the front plate of the fixture and driven through a lever arrangement by a cam actuated by a follower on the machine bed. As each cut is made, a stop on the table turns a sprocket with as many teeth as the gear being machined, plus a slot for a pin which turns off the machine when the gear is done. About 3 parts per min. are produced with the blank held by a thumb-operated lever actuating an expanding arbor



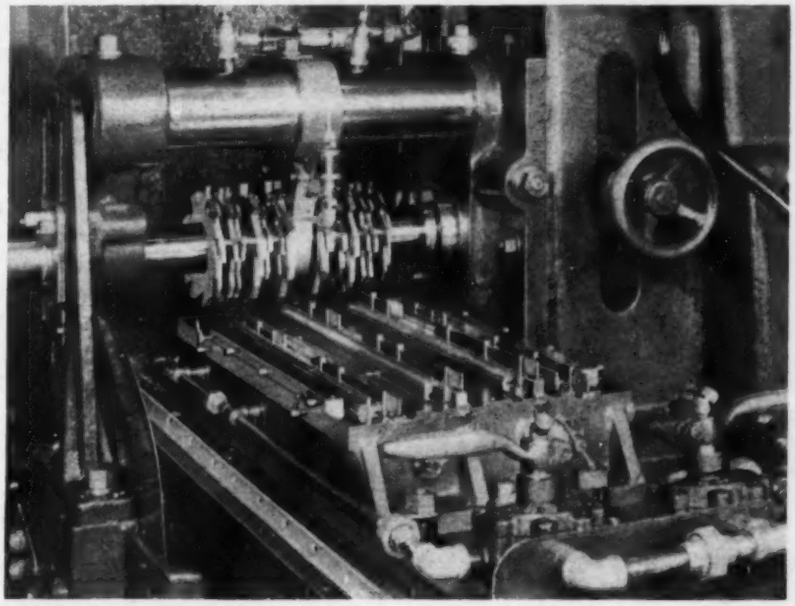
MACHINING OSCILLATING CAMS . . Oscillating face cams are hand-milled. The master is on the 10-rpm., motor-driven arbor that carries the blank, and moves it back and forth endwise by contacting a follower on the fixture frame. When the first cam slot is finished, the follower is lifted against its spring pressure and engaged in the second slot in the master. Infeed is manual, the operator keeping pressure on the cross-feed. Lubricant is a 50-50 light mineral oil and kerosene



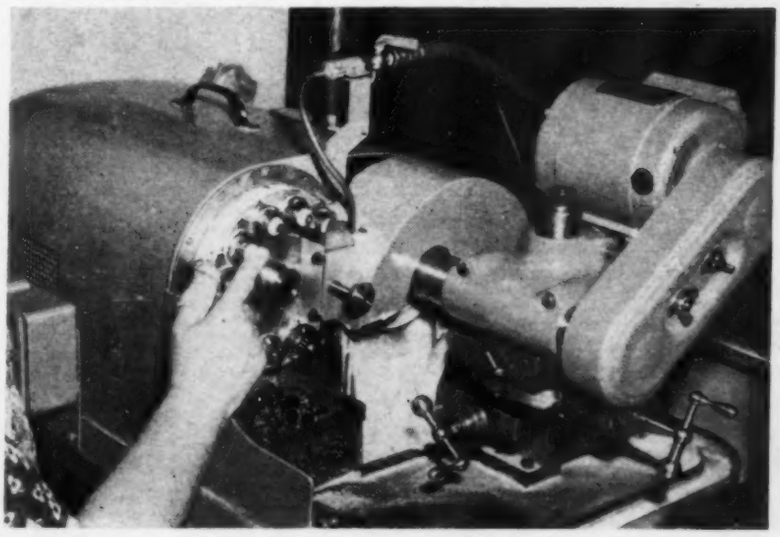
MULTIPRESS BROACHING.. Changing from single press to 4-ton Multipress broaching upped production of bronze adding and subtracting gears to one every 3 sec. The bore, reamed to 0.1865 to 0.1875 in., is broached to a square hole 0.157 to 0.1575 in. over the square and 0.771 to 0.775 in. long. The rotating table carries six fixtures, the upper part of each having an open slot into which blanks are nested. As the broach, limit-switch controlled and automatically lubricated, retracts, the gear is pulled halfway up in the fixture—until its bottom catches the stripper—and is air ejected

KEYTOP PAINTING . . Conveyorizing the painting of keytops has halved production time. The first operator feeds keytops on double-pin fixtures spaced every 6 in. on a roller chain, sprocket-driven at 8 ft. per min. Second operator daubs on paint, third and fourth wipe off excess, and fifth and sixth clean tops with solvent. Tops are ejected by felt guides that taper up to lift the tops off the pins so air can blow them into side chutes. Infrared bulbs at far end of conveyor dry paint in cold weather, but are not usually needed as the paint is a quick-drying, heavily pigmented lettering paste. Direction of conveyor travel is counterclockwise

HYPERMILLING CARRIAGE RAILS . . Dural extruded to approximate shape is milled, 4 parts at a time, at 12 ipm. and 1.570 sfpm. with carbide-tipped gang cutters. Rails, about 16 in. long, 1 3/16 in. wide and held to 0.002-in. tolerance, are mounted in an air-operated fixture having four stations for inside and outside milling of both parts of rail. Side screws locate pieces in end stations for final cuts, while keys in slotted pins clamp them tightly as pins are pulled down by air pressure. Milling is done with 80:20 soluble oil at 12 complete rails per hr. and 3,650 pairs of rails between grinds. The K&T miller was converted for carbide by mounting a flywheel and air brake on the rear of the spindle. Chips and oil are thrown into a hopper from which oil is drained and recirculated by pump



Photos courtesy Friden Calculating Machine Company, San Leandro, Calif.



GRINDING DIALS . . Calculating-machine dials are numbered from 0 to 9 around outside surfaces. Painting the numbers is facilitated by stringing the dials on rods and dip painting so paint covers the whole edge. Excess paint is then removed by grinding the surface without touching paint in the depressed numbers. Dials are hand-fed onto a 12-station wheel that rotates past an A-60-K-6-V wheel, crush-dressed every 3 days. A cam inside the head provides a dwell at the grinding position, at which time the part is revolved by a friction wheel contacting the end of its fixture that extends through the circular plate into the machine head. Lubricant is a 20:1 soluble-oil mixture

Gage-Zone System Harmonizes Delivery and Acceptance Inspection

Proposed system of inspection assures that parts made to the vendor's gages will always pass the customer's gages, and will aid the services and industry

BY JOHN GAILLARD
Mechanical Engineer
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MUCH confusion and controversy have arisen through lack of a standard for the relationship of specified manufacturing limits of a cylindrical part to permissible variations in size of limit gages employed for inspecting that part.

This situation will cause no surprise because inspection is a complicated problem and in general consists of three phases:

1. *Workshop inspection,* whereby the machine operator checks parts coming from his machine for acceptable sizes, using workshop gages.

2. *Delivery inspection,* made in the parts-manufacturing plant to determine whether the parts are suitable for delivery to another department or plant of the same company or to a customer.

3. *Acceptance inspection,* made by the receiver of the goods to determine whether they shall be accepted or rejected.

This article will deal mostly with the relationship of delivery inspection to acceptance inspection. Great difficulties arose during World War II because large volumes of parts were subject to acceptance by inspection with Army Ordnance gages.

The Ordnance specification for gagemaker's tolerances and gage wear allowances adopted in 1927 followed the principle laid down in the Tentative American Standard "Tolerances, Allowances and Gages for Metal Fits, B4a-1925," (now abolished). According to this document the sizes of plain limit gages shall not exceed the limits specified on the part drawing.

The new American Standard, "Limits and Fits for Engineering and Manufacturing, B4.1-1947" reaffirms the principle just mentioned where it says: "A part shall be acceptable if its actual size does not exceed the limits of size specified in numerical values on the drawing or in writing. It does not meet dimensional specification if its actual size exceeds those limits."

Essentially, a limit gage is intended to represent the dimension of the part limit to be checked with the gage. This limit is the gage's *nominal size.* Its actual size will usually differ slightly from the nominal for two reasons: First, the size of a new gage may vary within the gagemaker's limits; second, a gage will wear from use, especially a Go gage.

But the Ordnance gaging inspection system of 1927 was based solely on the numerical value of the part tolerance. No consideration was given to the nominal size of the part, hence, of the gage. A hole tolerance of 0.0020 in. might apply to a 1-in. hole or a 6-in. hole, but the gage tolerances and gage wear allowance would be the same in both cases, as well as their location in relation to the part limits. For hole limits 1.0000 and 1.0020 in., a new Ordnance inspection Go plug gage was to be held within gagemaker's limits 1.0002 and 1.0001 in. as at *A,* Fig. 1. This left a gage wear allowance of 0.0001 in. for the Go plug gage, to reach the Go limit of the hole (1.0000 in.), when it had to be withdrawn from use. A new Ordnance inspection Not Go plug gage was to be held within gagemaker's limits 1.0020 and 1.0019 in., no wear allowance being specified.

In 1944 the Ordnance specification was revised. The gagemaker's tolerances and gage wear allow-

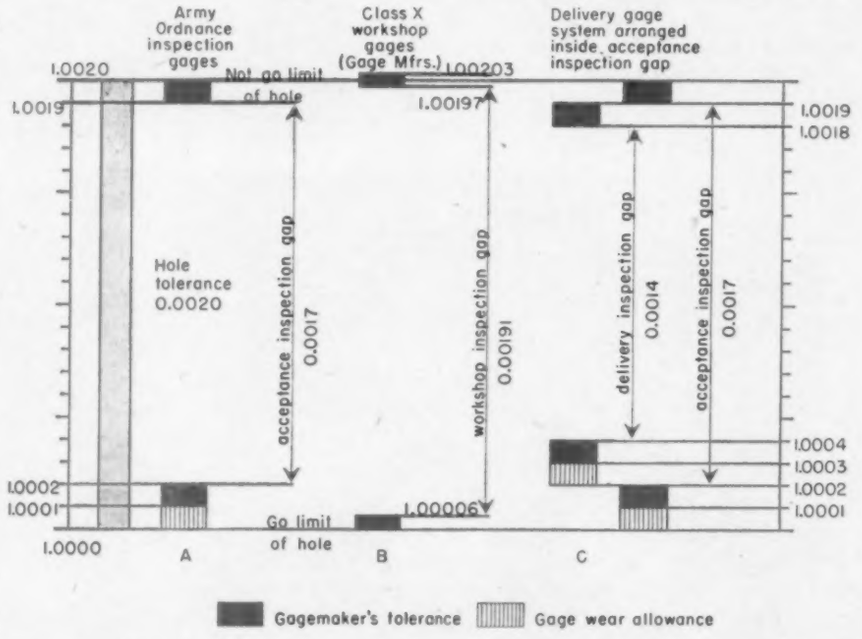


Fig. 1—Different ways of locating the gagemaker's tolerances and gage wear allowances relative to the part (drawing) limits

ances were now based, not only on the part tolerance, but also on the nominal size of the gage. For a 1-in. hole with a tolerance of 0.0020 in. the arrangement shown at *A*, Fig. 1, still applies.

The Army Ordnance system is intended solely for acceptance inspection of parts by Ordnance inspectors. How the parts are to be held within the acceptance inspection limits is a problem to be solved by the supplier. He must devise his own system.

Reduction of Drawing Tolerance

The supplier must realize that he does not have the full benefit of a part tolerance shown on the drawing, if he wants his parts to pass acceptance with Ordnance gages. As shown at *A*, Fig. 1, the Ordnance Go plug gage may be as large as 1.0002 in. and the Not Go gage, as small as 1.0019 in. Therefore, holes having actual sizes that are within the drawing limits, but are smaller than 1.0002 in., or larger than 1.0019 in., *may* in extreme cases be rejected by Ordnance inspection gages.

However, the Ordnance Department has made it clear that whenever such a rejection occurs:

> "The contractor always has the right . . . to request direct measurement of his product by precision measuring equipment" and that "when this measurement is made, the work is considered acceptable if it exceeds specified limits by an amount not greater than the accuracy of the measuring instrument used."

The obvious intent of this statement is to grant the supplier not only the full range of the drawing tolerance, but also to give him the benefit of the doubt caused by the error of measurement. (*Note:* This intent would be clarified by the addition of the word "even" between "acceptable" and "if it exceeds.)"

Although the Ordnance Department thus recognizes the supplier's right to the full drawing tolerance, there may be considerable loss of time and money before this right has been established in a specific case. Especially in wartime, when industry is under tremendous pressure and time is invaluable, the motions required for going through an appeal procedure may mean a serious loss to all parties: subcontractors, contractors and the Government.

Therefore, when starting to make the parts, the supplier should take into account the greatest possible reduction of the drawing tolerance that may result from compliance with acceptance by Ordnance inspection gages. In Fig. 1 at *A*, the minimum tolerance that actually may be available to the supplier is 0.0017 in., or 85% of the drawing tolerance. This minimum will be called here the *acceptance inspection gap*. The supplier must keep in mind the numerical value of this gap and its location relative to the part limits.

Table 1—Gagemakers' Tolerances According to Gage Manufacturers' Catalogs

Nominal Gage Size, In.		Gagemaker's Tolerance, In.				
above	to and including	Class XX (internal gages only)	Class X	Class Y	Class Z	Class ZZ (ring gages only)
0.029	0.825	0.00002	0.00004	0.00007	0.00010	0.00020
0.825	1.510	0.00003	0.00006	0.00009	0.00012	0.00024
1.510	2.510	0.00004	0.00008	0.00012	0.00016	0100032
2.510	4.510	0.00005	0.00010	0.00015	0.00020	0.00040
4.510	6.510	0.000065	0.00013	0.00019	0.00025	0.00050
6.510	9.010	0.00008	0.00016	0.00024	0.00032	0.00064
9.010	12.010	0.00010	0.00020	0.00030	0.00040	0.00080

Gage Manufacturers' Practice

During the war, much trouble arose because the above point was not observed. Many firms used limit gaging for the first time. They did not know how variation in gage size influences the amount of tolerance left available to the supplier for delivery inspection and workshop inspection. Besides, the supplier might order gages without specifying limits within which each gage was to be held. In various gage manufacturers' catalogs, the parts supplier would find (and still finds) a table of gagemaker's tolerances applicable to plain limit gages of different grades of accuracy (designated as Class X, etc.) for various ranges of nominal sizes. See Table 1. These data had been adopted before the war by the Gage Manufacturers Association (abolished). However, there did not exist during the war, nor does there exist now, any rule generally adopted by industry for determining the location of the gagemaker's tolerances in relation to part limits.

Catalogs of some gage manufacturers state that unless the customer gives special instructions, the tolerance on a workshop Go plug gage will be applied as a plus tolerance on the Go limit of the hole, and the tolerance on the Not Go plug gage will be equally distributed on both sides of the Not Go limit of the hole. (The latter practice is not in accordance with the principle laid down in B4a-1925 and recognized again in B4.1-1947, as previously mentioned).

This setup is intended to keep as large a percentage of the drawing tolerance as possible available to the workshop.

If then, during the past war, a supplier of holes (limits 1.0000 and 1.0020 in.) ordered Class X plug gages (gagemaker's tolerance 0.00006 in., Table 1), without giving special instructions, he would receive Go gages held within 1.00006 and 1.00000 in., and Not Go gages held within 1.00203 and 1.00197 in., see *B*, Fig. 1. With such gages, the delivery inspection gap is 0.00191 in., or 95.5% of the drawing tolerance.

Comparison of these gages with those of the Ordnance inspector, *A*, Fig. 1, shows that the supplier's largest Go gage (1.00006 in.) accepts hole sizes from 1.00006 to 1.00020 in., but these holes will be rejected by the largest Ordnance Go gage (1.0002 in.). This incon-

sistency becomes worse for the supplier when he uses a Go plug gage smaller than 1.00006 in.

On the other hand, the situation becomes more favorable for the supplier when the Ordnance inspector uses a Go gage smaller than 1.0002 in. In fact, when the supplier uses a Go plug gage, size 1.00005 in., and the Ordnance inspector has a Go gage, size 1.00003 in., the latter will accept all holes passed by the supplier's gage.

Overlap of Zones

The inconsistency of results obtained by delivery and acceptance inspection performed in the manner described arises because there is an overlap between the zone of total permissible variation in the size of the Go gage used for delivery inspection and the zone of the corresponding gage used for acceptance inspection. Consequently, the supplier does not know, in any particular case, whether his gage is smaller or larger than the Ordnance inspection gage to be used for acceptance, or whether the two gages are of equal size.

From experience with gages purchased on the basis of the gage manufacturers' practice, some suppliers have wondered why the use of the more accurate Class X plug gages appeared to lead to more rejections by Ordnance inspection gages than did use of Class Y delivery inspection gages. It should now be clear that this situation results from the fact that the gagemaker's tolerance is located directly on the Go limit of the hole. As the tolerance is smaller for Class X than for Class Y gages, the actual sizes of Class X plug gages will on the average be smaller than those of Class Y plug gages.

Trouble similar to that described for the Go side of the part tolerance may be experienced on the Not Go side. But the actual sizes of parts kept under proper dimensional control will usually remain some distance away from the Not Go limit. Inconsistencies on this side of the part tolerance will be less frequent than on the Go side. Putting it differently, if the sizes of the parts more or less consistently exceed the Not Go limit, the chances are that the product is so much out of control that it will be rejected by the delivery inspection Not Go gage. Hence, the product will not reach the acceptance inspection phase.

Further trouble arises when the supplier uses dial gages set closely to the drawing limits of the part, in order to benefit as much as possible from the drawing tolerance. This practice may easily lead to the production of parts having sizes lying quite close to the Go limits, and likely to be rejected by Ordnance inspection Go gages.

It may be argued: (1) it is unlikely that an Ordnance inspection Go plug gage is just up to the maximum gagemaker's limit, and (2) said gage happens to be used for checking holes with sizes close to their Go limit. More likely, a new Ordnance gage will be smaller than the permissible maximum and will wear smaller. But, the same reasoning applies to the Class X plug gage. This gage also is likely to be smaller than its maximum gagemaker's limit (1.00006 in.) and also is subject to wear in use.

Drawing Tolerance "Throttled"

Readers may contend that one is unduly pessimistic to assume that the acceptance inspection gap may be as small as 0.0017 in. This will be true only if the largest permissible new Go gage is used in combination with a Not Go gage worn to its smallest permissible size. On the other hand, if the supplier assumes that his product has to pass the acceptance-inspection gap, he may be over-conservative, but he also plays safe and avoids any difficulties of the kind described. Moreover, although the acceptance-inspection gap may never occur as an actual minimum, there is a greater chance that either the acceptance-inspection Go gage, by having its maximum metal size, or the acceptance-inspection Not Go gage, by having its minimum metal size, will do most to "throttle" the drawing tolerance. The supplier has no way of knowing on which side of the part tolerance this "throttling" will occur.

Finally, it may be assumed that with proper size control in producing the holes, their actual sizes will cluster about an average size located near the halfway mark between the part limits or, in the example under consideration, somewhere around 1.0010 in. If so, inconsistencies that occur in regard to acceptance or rejection of holes having sizes lying near the drawing limits, will have but little effect on the inspection of the bulk of the parts. On the other hand, holes having sizes lying near their Go limit have the most metal around them and, hence, are likely to have the longest wear life. However, as we have seen above, if the supplier produces such holes, he runs a greater chance of having them rejected by Ordnance inspection gages than when he produces larger holes with less wear life.

To Solve the Problem

The uncertainties and troubles described would be avoided if the supplier used a set of delivery-inspection gages as indicated at *C*, Fig. 1. Here, the gagemaker's tolerances and wear allowances are kept inside the acceptance-inspection gap. Any hole passing these gages will also pass the Ordnance inspection gages.

The price paid for this solution of the problem is a further reduction of the drawing tolerance. The delivery-inspection gap is narrowed to 0.0014 in., or 70% of the drawing tolerance. Reduction of the tolerance available to the workshop increases production cost. When the part tolerance is small, it may be practically impossible to reduce it for delivery inspection, as well as acceptance inspection, and still have enough tolerance left for the workshop.

Two Criticisms

The Ordnance system has been criticized by industrial concerns on two accounts. One objection is that shifting the gagemaker's tolerance rather far into the drawing tolerance, as at *A*, and *C*, Fig. 1, unduly narrowed the acceptance-inspection gap. The obvious reason for the Ordnance Department's doing so was to get the longest possible wear out of its inspection gages. This is understandable if we realize how much wear these gages were subjected to during the war production period. In contrast it is

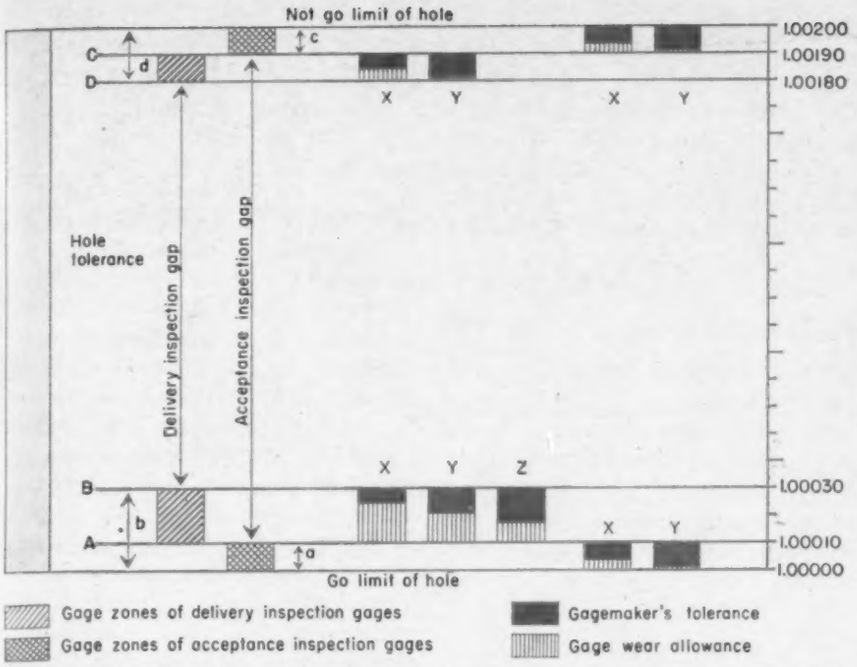


Fig. 2—Location of gage zones and their distribution between gagemaker's tolerance and gage wear allowance

the gage manufacturers' practice to place the Go tolerance directly inside the Go limit of the part, in order to give the gage user (supplier of parts) the greatest possible benefit of the drawing tolerance, as at *B*, Fig. 1. Possibly, a compromise between these two approaches may be worked out that would be satisfactory to industry as well as Army Ordnance.

The second objection raised by industry was that the Ordnance system was intended to apply to parts with tolerances of 0.0005 in. and even smaller, thus leaving too little tolerance for the shop. For such small part tolerances, the acceptance-inspection gap becomes too narrow for placing inside it a workable delivery-inspection gap plus gagemaker's tolerances and wear allowances for the delivery-inspection gages, as at *C*, Fig. 1. This difficulty becomes more serious as the part tolerance becomes smaller and the gage size becomes larger. Some experts hold that inspection by means of plain limit gages should not be applied to parts with a tolerance smaller than 0.0010 in. Others consider a part tolerance of 0.0020 in. as the practical minimum in this respect. We shall see later that the problem of coordinating the acceptance- and delivery-inspection gaps can be solved without reducing the drawing tolerance as much as shown at *C*, Fig. 1.

Basic Layout of Gage Zone System

In a system involving delivery inspection by the supplier and acceptance inspection by the customer, we must deal with two Go and two Not Go gages. Clearly, it does not matter whether the size of any of these gages is the result of the gage having been newly made with that dimension, or whether it is the result of wear. Therefore, in so far as the results of gaging inspection are concerned, either for delivery or acceptance, we are interested primarily in the widths and location of the four gage zones.

Delivery and acceptance inspection can be harmonized by a standard system of gage zones based on the adoption of four gage zone limits represented in Fig. 2 by the lines *A*, *B*, *C* and *D*, located inside the drawing limits of the part.

In the case of a hole tolerance, line *A*, located at a distance *a* from the Go limit of the hole, is the maximum gagemaker's limit of the acceptance-inspection Go plug gage. Line *A* is also the wear limit of the delivery-inspection Go gage.

Line *B*, at a distance *b* from the Go limit of the hole, is the maximum gagemaker's limit of the delivery-inspection Go plug gage.

Line *C*, at a distance *c* from the Not Go limit of the hole is the wear limit of the acceptance-inspection Not Go plug gage. The maximum gagemaker's limit of this gage is the Not Go limit of the hole. Line *C*, is also the maximum gagemakers limit of the delivery-inspection Not Go plug gage.

Line *D*, at a distance *d* from the Not Go limit of the hole, is the wear limit of the delivery-inspection Not Go plug gage.

Gage zone limits are shown in Fig. 2 for a hole tolerance, but may be established in a similar way inside the drawing tolerance for a shaft.

This basic layout reserves, for each of the four gages involved, a

Table 2—Gage Zones for Acceptance and Delivery-Inspection Gages

Function of Gage		Gage Zone			
		Symb	Gage Zone Limits		Zone Width
			max. metal	min. metal	
Acceptance Inspection	Go gage	A	line A	Go limit of part	a
	Not Go gage	C	Not Go limit of part	line C	c
Delivery Inspection	Go gage	B	line B	line A	(b-a)
	Not Go gage	D	line C	line D	(d-c)

zone of permissible variation in size of the gage. For easy identification, each gage zone may be designated by that gage zone limit which is located farthest inside the part tolerance. This setup is easy to memorize because the letters designating the zones of the acceptance-inspection Go and Not Go gages (*A* and *C*) are the first two letters of the word "acceptance."

The various features of a gage zone system, applicable to a hole as well as a shaft tolerance, are given in Table 2.

Numerical Values of Zone Widths

The basic layout can be made into a practical system by assigning numerical values to the distances *a*, *b*, *c*, and *d*. These distances must be chosen to provide gage zones of sufficient width to contain practicable gagemaker's tolerances and, in addition, adequate gage wear allowances. It is assumed here that even Not Go gages are subject to wear. Although normally only few parts are rejected by Not Go gages, a slight amount of wear is caused every time such a gage enters a hole or passes over a shaft.

The values of *a*, *b*, *c* or *d* would be generally acceptable to industry. The basis for an American Standard, for example, is a question to be decided by a consensus of the major groups of manufacturers and users of gages, and the Armed Services. To the latter, the problem is one of major importance. The adoption of a single standard system of gaging inspection applicable to wartime, as well as peacetime, production will make it unnecessary for industry to change over, in a war emergency, from its own system to a different one made mandatory by the Government.

Proposal for Trial

To give concrete shape to a gage zone system, a proposal is herewith submitted for a trial by those interested in a standard system. This is based on the following relationships between the distances *a*, *b*, *c* and *d* on the one hand, and the part tolerance *T* on hole or shaft, on the other:

- $a = 0.05\ T$; maximum value 0.0005 in.
- $b = 0.15\ T$; maximum value 0.0015 in.
- $c = 0.05\ T$; maximum value 0.0005 in.
- $d = 0.10\ T$; maximum value 0.0010 in.

These values result in an acceptance-inspection gap of 90%, and a delivery-inspection gap of 75% of the part tolerance, for all part tolerances up to and including 0.0100 in.

For larger-part tolerances the percentages are higher because a maximum has been set for the width of each gage zone. Table 3 is based on the above-mentioned ratios applied to part tolerances 0.0010 in. and above, listed as recommended tolerances in Table 2 of the American Standard, "Limits and Fits for Engineering and Manufacturing, B4.1-1947."

Distribution of Gage Zones

Application of the proposed system (Table 3) to a 1-in. hole, limits 1.0000 and 1.0020 in., is represented in the right-hand portion of Fig. 2. In this case the supplier has a choice between three classes of delivery-inspection Go plug gages. All have the same maximum gagemaker's limit (1.00030 in.) and the same wear limit (1.00010 in). The supplier is free to decide in each case whether it is preferable to use a delivery-inspection gage with a small gagemaker's tolerance, leaving ample room for gage wear, or whether a gage with a more liberal gagemaker's tolerance, but a probable shorter wear life, will be more economical. Whatever his choice, it will not affect the results of the acceptance inspection. In the case of Fig. 2, the supplier has the following choice:

Delivery Inspection Go Plug Gage	Gagemaker's Tolerance (in.)	Gage Wear Allowance (in.)
Class X	0.00006	0.00014
Class Y	0.00009	0.00011
Class Z	0.00012	0.00008

Table 4 shows that for a part tolerance of 0.0020 in., delivery-inspection Go gages, Class X, Y, or Z can be used for nominal part sizes to and including 4.510 in. Table 4 shows also that in eight cases, involving small tolerances on large parts, it would be necessary to use delivery-inspection Go plug gages, Class XX. This class of gage has a very close gagemaker's tolerance and is intended for use as a laboratory gage or setting plug for snap gages, rather than as a regular inspection gage. Therefore, Class XX gages may be ruled out for the latter purpose. In doing so, we find that the use of plug gages for delivery inspection becomes prohibitive for parts to be held within a tolerance of 0.0012 in. or less, having nominal sizes above 4.510 in., and for parts to be held within a tolerance of

Table 3—Proposed Numerical Values of Gage Zone Limits for Delivery- and Inspection-Acceptance Limits

Part Tolerance[1] In.	Location of Gage Zone Limits, In.			
	a	b	c	d
0.0010	0.00005	0.00015	0.00005	0.00010
0.0012	0.00006	0.00018	0.00006	0.00012
0.0015	0.00008	0.00023	0.00008	0.00016
0.0020	0.00010	0.00030	0.00010	0.00020
0.0025	0.00013	0.00038	0.00013	0.00026
0.0030	0.00015	0.00045	0.00015	0.00030
0.0040	0.00020	0.00060	0.00020	0.00040
0.0050	0.00025	0.00075	0.00025	0.00050
0.0060	0.00030	0.00090	0.00030	0.00060
0.0080	0.00040	0.00120	0.00040	0.00080
0.0100 and above	0.00050	0.00150	0.00050	0.00100

[1]For a part tolerance lying between two values listed in this column, use the values of *a*, *b*, *c* and *d* applying to the next smaller part tolerance listed.

TABLE 4—Choice Between Delivery Inspection Go Plug Gages, Class X, Y or Z, for Different Size Ranges and Hole Tolerances

NOMINAL SIZE OF PLUG GAGE (Inch)		HOLE TOLERANCE (Inch).						
From	To and including	.0010	.0012	.0015	.0020	.0025	.0030	.0040 and above
0.029	0.825	Z[1]	Z	Z	Z	Z	Z	Z
0.825	1.510	Y[2]	Z	Z	Z	Z	Z	Z
1.510	2.510	X	Y	Y	Z	Z	Z	Z
2.510	4.510	X	X	Y	Z	Z	Z	Z
4.510	6.510	XX[3]	XX	X	Y	Z	Z	Z
6.510	9.010	XX	XX	XX	X	Y	Y	Z
9.010	12.010	XX	XX	XX	X	X	Y	Z

[1] Instead of a Class Z gage, a Class Y or Class X gage can always be used.
[2] Instead of a Class Y gage, a Class X gage can always be used.
[3] Use of Class XX gages for delivery or acceptance inspection is not recommended.

0.0015 in. or less, having nominal sizes above 6.510 in.

Advantages of Gage Zone System

A gage zone system establishes a definite relationship between delivery and acceptance inspection, so that parts passed by the delivery-inspection gages will always be passed by the acceptance-inspection gages. The element of confusion caused by the overlapping of zones of permissible gage variation has been eliminated. But the system is flexible in that the supplier usually has a choice between two or three gages with different degrees of accuracy. This enables him to select, in each case, the most economical combination of initial gage cost and cost of gage usage (wear life). Gages belonging to the same gage zones are interchangeable in regard to inspection results, independent of their class. If the supplier of parts cannot purchase Class Y gages, but Class X gages are available, he can use the latter. The opposite is true, provided the gage zone is at least as wide as the gagemaker's tolerance on the Class Y gage.

If future technical progress makes it possible to reduce gagemaker's tolerances and the supplier wants new gages held to the closer tolerances, this will not disturb his original setup. If the original gage zones are maintained, reduced gagemaker's tolerances will leave more gage wear allowance. Also, by using hard alloys for the gages, such as tungsten or boron carbide, the gage zone limits can be brought closer to the corresponding part limits and still leave adequate gage wear life. The delivery- and acceptance-inspection gaps will then be increased, which makes production easier and more economical.

Workshop Inspection

To be consistent in systematizing inspection procedure, the supplier would use workshop inspection gages with gage zones located inside the delivery-acceptance gap. However, this would mean a third reduction of the drawing tolerance, which is obviously undesirable. Such reduction is not necessary because the supplier can centralize controls of delivery and workshop inspection in the same department. Therefore, the gage zones of a workshop-inspection gage and the corresponding delivery-inspection gage can be the same, and both kinds of gages can be ordered held within the same gagemaker's limits. Only, to avoid inconsistencies between gaging results caused by overlapping of gage zones, the supplier must establish a demarcation line between the sizes of gages to be used for workshop inspection and those to be used for delivery inspection.

Fig. 3 represents the gage zone of the delivery-inspection Go plug gage in Fig. 2. If Class X plug gages are ordered for workshop and delivery inspection, the gagemaker's limits being 1.00030 and 1.00024 in., the supplier may decide that gages larger than 1.00015 in. shall be used for workshop inspection and gages measuring 1.00015 in. or less, for delivery inspection. This means all new plug gages must be given to the workshop and that delivery inspection must be performed only with worn gages.

Trial in Practice

Inquiries from industry as to whether there exists a generally adopted industrial system gaging inspection have indicated interest in the establishment of a national standard in this field. The system according to Table 3 is given here as a proposal which may be of value to some companies.

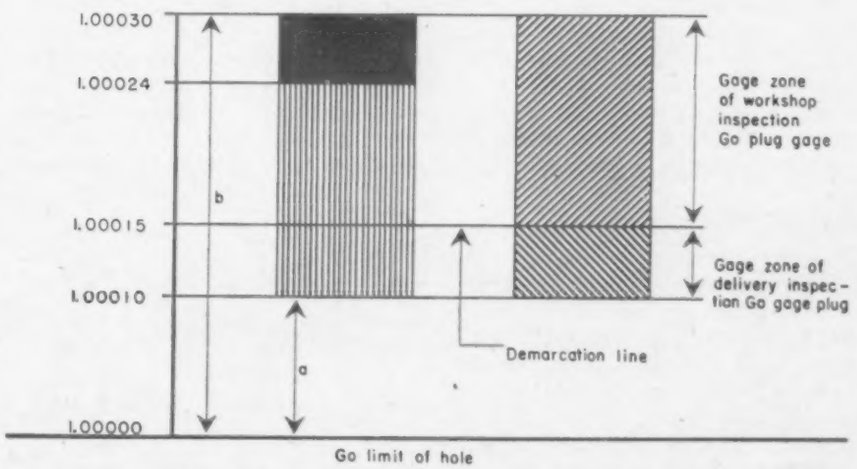


Fig. 3—Demarcation between the workshop and delivery-inspection gage zones

TALKING SHOP

Rut Trouble

ENGINEERS can get in a rut like anyone else—as they learned to their sorrow at one instrument plant. When enlarged production involved more tooling than they could handle, tool engineers sought aid from a Detroit firm used to thinking in terms of auto production—drill jigs of ¾-in. steel. But parts weighed only a few ounces, so the instrument maker objected to the weight. The Detroit suggestion was to mount an auxiliary plate on the drillpress with rollers to move the jigs.

Solution of the instrument maker, who was not in an auto rut, was to make jigs of 5/16-in. steel. These were of ample weight, could be easily handled.

Pressure Castings

WAGNER ELECTRIC is using pressure aluminum castings for automotive hydraulic cylinders, pistons and brake shoes with excellent results. Die-cast aluminum has also proved out for small-motor end-bells. Die-cast aluminum is delivered to machining departments at the same price as cast iron, so the company uses aluminum wherever machining operations can be reduced.

Editors Disagree

CHESTER RICKER, our Detroit man, in his recent story on automotive conveyor developments, said Henry M. Leland came from Pratt & Whitney. Fred Colvin, editor emeritus, says it was Brown & Sharpe, and Ricker blushingly agrees. Further, Colvin, who first described Ford production methods back in 1913 in a 16-article *A.M.* series, says he believes Harold Wills developed the conveyor assembly line. Ricker had said it was Charles E. Sorenson—who has received credit in print. Colvin says Sorenson did some great work, but didn't develop the line. Colvin was there, and should know.

Ubiquitous Gantry

GANTRY CRANES provide great flexibility in loading and unloading heavy workpieces from large machine tools. One good method is to have two rails inset in the floor along either side of the shop center aisle. Gantrys are provided for each two bays. They move up and down the shop for this distance, serving six or a dozen big machines. If the overhead craneway is 300 or 400 ft. long, it is a good idea to have up to five traveling cranes to place raw material—castings or forgings—in stock piles at each unit of two bays. The gantrys then do the rest of the lifting until the big cranes are called back to remove finished parts.

Labor-Management

A LABOR MANAGEMENT committee, wartime style, has been found the most effective method of working with labor by one electrical manufacturer. All company information to employees goes through the committee, composed of a man elected from each department, union officials and several shop executives—but no administrative executives. The committee also handles suggestions, selects shop posters, gets out the plant paper, has worked out a system whereby workers contribute 10 cents a week to a common fund for donations to charities and similar worthy causes which normally irritate men. The L-M committee even located 200 blood donors.

Harmony

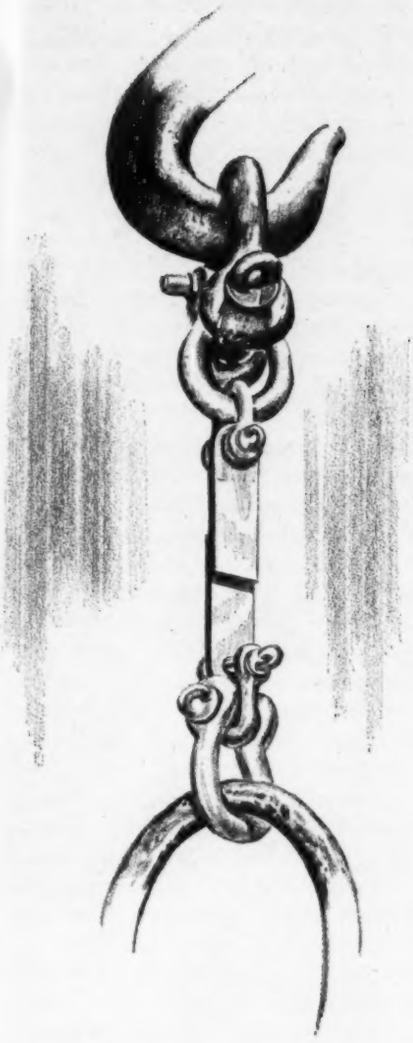
IN ONE Midwestern city, all metal-working plants use incentives—usually piecework—extensively with no objection from unions. The reason seems to be that companies always work through unions, and the latter are convinced the companies are neither trying to circumvent nor to break unions. Grievances are handled promptly through stewards, companies are firm and fair. One company makes sure workers have regular grievances, even supplies some if necessary so all goes well.

Similarize Conditions

PRODUCTION ESTIMATES for new machines can go haywire if both buyer and seller do not take all circumstances into account. Recently, the purchaser of a large machine complained bitterly that his shop could not get anywhere near the guaranteed estimate. Investigation showed that the operator often had long waits for the crane. On the other hand, the builder always uses jib cranes at all large machines in his own shop to cut down loading and unloading time and figured accordingly. Ultimately, of course, the buyer benefited because he was made aware of the importance of materials handling.

Extruded Zinc

ZINC IS BEING USED for extruding complicated parts. First such operation was cylindrical flashlight battery cans, now there are special shapes for shields in transmitters, transformers, condensers and other parts in auto radio receivers, fluorescent lights, advertising signs and soft-drink dispensers.



Adhesives for Metalworking

BY H. E. LINSLEY, ASSOCIATE EDITOR, AMERICAN MACHINIST

ONE of the most notable contributions to industrial progress has been the development, during the past few years, of thermosetting adhesives of almost unlimited versatility. These compounds found their first major field in aircraft work where they have in many cases replaced rivets; giving a smoother airfoil surface and improved air flow. Their insulating properties tend to prevent corrosion between different metals, and they possess sufficient elasticity to compensate for different coefficients of expansion.

Although their widest use at present is in the manufacture of plywoods and similar materials, no attempt has been made in this report to describe these applications, and attention has been paid only to those joints in which at least one component is of metal.

The technique makes available constructional materials in which factors such as strength, beauty, light weight, resilience, and many others can be combined at the will of the designer.

IN ONE FORM or another, adhesives have been known to, and used by, man for many centuries. Their invention, like many another, has been attributed to the Chinese, but there is little doubt that the adhesive properties of various natural substances were appreciated by different peoples in all parts of the world and were applied in forms suited to their varying degrees of civilization.

Early Adhesives

The early adhesives were invariably natural products such as gums and resins exuded by trees, or were obtained by pressing or cooking various plants and roots. Fish and animal glues were also obtained by boiling bones, hides and offal. Other substances which also appear to have been in use from very early times include bitumen and wax, but these have relatively poor adhesive properties and were probably used more as sealants. With very few changes, save in the manner of preparation and a broadening of the raw material source, these simple, natural adhesives have continued in use to the present time.

Ordinary pastes consist essentially of solutions of starch or dextrin, to which may be added various gums, resins or glues. Antioxidants are usually added to improve durability, but most of them deteriorate on exposure. Tapioca, rice, wheat and corn are the most common sources of the starch.

Mucilage is composed of a light vegetable gum soluble in water. Fish glue is prepared by cooking the skin, bones and internal organs of fish. It is convenient to use, being in liquid form, and creates a strong bond for porous materials. Its strong, unpleasant odor, however, discourages its use. Where a cold liquid glue is desired, a useful substitute can be made by swelling ordinary glue in water and heating in a mixture of acetic acid and water.

Ordinary glue is obtained by boiling bones, hide, hoofs and other parts of cattle and horses, as in extracting gelatin. In fact the only difference between edible gelatin and glue lies in the degree of purity. It is marketed in thin translucent sheets, varying in color from pale amber to dark brown, and is virtually insoluble in cold water. It melts readily in hot water and should be used very hot. For best results, glue should be applied in a thin coat and there should be a minimum of clearance between the parts. Pressure should be applied until the glue has hardened.

Other adhesives in common use include those made from casein, which form exceedingly strong joints, and the so-called household cements which are generally solutions of nitrocellulose or cellulose acetate in chemical solvents. These latter will adhere to almost any material, set rapidly because of the high volatility of the solvent, and have a bond strength of about 20 psi. Plasticizers in the form of gums or synthetics are frequently added, or they may be compounded with resins. Old motion-picture film, cleaned of the emulsion and dissolved in acetone forms a useful cement of this type.

In metalworking, these common adhesives find only indirect applications, as in the pattern shop, the shipping room or for labeling for identification. Even this latter is fast becoming obsolete in favor of the more popular pressure adhesives which will stick to almost any surface and are moisture resistant. Where ordinary pastes must be used for attaching labels to tinplate, adhesion can be greatly improved by rubbing the surface of the metal with a few drops of tincture of myrrh.

Glue Still Used

The use of glue still persists as a means of bonding abrasive grains to felt wheels for polishing. The wheel is given a heavy coat of hot glue and then rolled in a trough filled with the abrasive and allowed to dry. When the abrasive has been worn away by use, the old glue is cracked off with a hammer and the process repeated. Although very widely used, the process is not as cheap as might appear. It is difficult to obtain an even coat of abrasive and there is considerable waste of material. Furthermore, when the wheels are in continuous use, breakdown is rapid and a considerable stock of freshly coated wheels must be kept on hand. It is not unusual to keep one man devoting full time to preparing wheels when many are in use. With the recent developments in plastic-bonded abrasive belts, it seems probable that this last stronghold of glue may soon pass into the discard.

Metal Adhesives

Industry has long felt the need for some means whereby metals could be attached to similar or dissimilar materials without the use of rivets, screws or other methods involving the piercing of holes and the production of surface irregularities. Soldering and welding are applicable to metal-to-metal joining, but are limited in their applicaton by the metals themselves and frequently by the undesirable temperatures involved. For attaching metal to other substances they are useless except in a few cases where the nonmetallic surface may be copper plated and attached by soldering.

Some 20 years ago, a measure of success was attained with casein-latex mixtures for attaching wood to metal, but the process did not attract much interest until the war focussed attention on the need for it. Most urgent was a means of bonding metal to metal, particularly for attaching thin sheet aluminum for aircraft wings and fuselages. Research was therefore directed first into the metal-to-metal field, and advantage was taken of the properties of some of the recently developed synthetic resins and rubbers. From these were produced Cycleweld, Pliobond, Metlbond, Redux, Reanite, Plastilock 500, and various others.

All these plastic bonding materials were designed primarily for bonding metals, either like or unlike, but serve equally well for metal to wood, metal to thermosetting plastic and to some thermoplastic materials, plastic to plastic, metal or plastic to rubber, metal to ceramics or metal to fibrous materials. Joints made by the process are not subject to localized loads and stresses, as in the

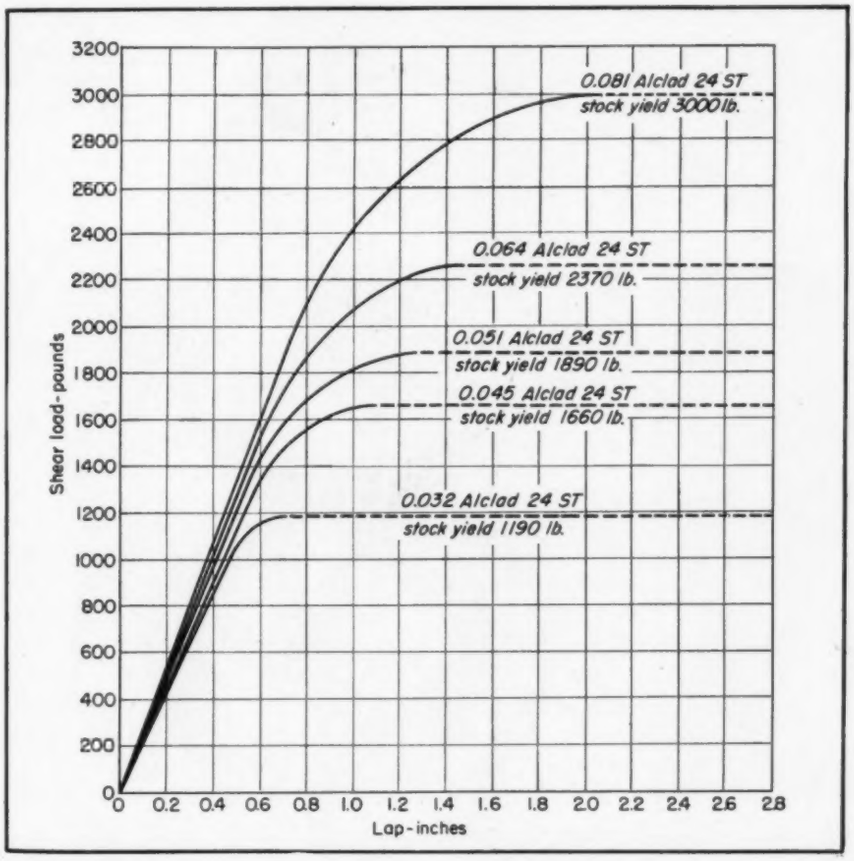
case of rivets or spotwelds, but the load is distributed over the entire joint area.

In designing for plastic bonding it is important for the designer to remember that the type of joint suitable for riveting or spot-welding cannot always be adapted to plastic bonding, even though the latter is usually stronger. Nor can every type of cement be used for every joint. Care must be taken in selecting the particular type most suited to the job, having due regard for the materials to be joined, the type of joint required, the fixtures employed, surface preparation and the method of application. Since these joints are strongest in shear, a lap or scarfed joint is the best form. Butt joints should be avoided as most cemented joints are weak in peel. For this reason also, bending that is concentrated at the edge of a bond should be avoided.

The tensile-shear strength of plastic joints is not directly proportional to the depth of lap, and as the maximum shear strength thus far developed is around 3000 psi. with most cements, it is obvious that metal-to-metal bonding must be restricted to the thinner gages.

Metal-to-metal adhesives are not a cure-all, although there are many applications where they may be used to advantage. There are, however, a great many variables whose origins are not yet fully understood, and the results obtainable in the laboratory are not always duplicated in production. Moreover, joints may be made one day with complete success, while those made the following day with the same batch of adhesive and under apparently identical conditions may fail completely. No positive recommendations can be made to cover all cases, but each job must be studied individually and the production procedure established by trial and error.

In deciding whether to use an adhesive process, a number of points must be kept in mind. It should be established whether the joint will be in tension or shear, and if so, to what magnitude. If it is subject to peel or impact it may be regarded as a poor risk unless adequate physical testing has proved otherwise. Temperature variations must also be considered, as the stability range of some adhesives is quite narrow, and bonds which are sound at room temperature are liable to be brittle at low temperature, and virtually nonexistent at elevated ones. If compounded to resist higher temperatures, they may be brittle at room temperature. Other conditions which may affect bonding properties are exposure to steam, moisture, acid or solvent fumes. It is also necessary to take into consideration whether the parts are of such size, shape, and material as to be able to stand the curing heat and pressure and to lend themselves to proper and economical jigging.



***SHEAR STRENGTH** of Cyclewelded single lap joints, 1 in. wide. Start of dotted lines indicates yield point of metal, shows futility of increasing lap beyond this*

Applications

Metal-to-metal bonds have been used with considerable success for attaching the metal skin to aircraft wings, for bonding stiffeners to aircraft flooring, and for similar applications, but there is still considerable hesitancy about using it because of its lack of uniformity. No nondestructive method of testing the soundness of the bond has yet been developed, although supersonic testers offer considerable hope in this direction. They are, however, too expensive for the small user. This same objection applies with equal force to glued joints in wood, but long experience and know-how have given users of these joints a measure of confidence that has yet to be built up for metal-to-metal joints. Ruptured or partially ruptured joints present a difficulty in field repair, as most service organizations are not equipped with the necessary jigs and hot presses for repair work. Generally speaking therefore, it is not considered advisable to place too much reliance on the process where structural strength is required. For decorative purposes, however, and for unstressed or lightly stressed joints, it does have a definite and growing place.

In the automotive field, for ex-

ample, metal trim can be attached with complete success, and the process can also be used for securing parts to the rear face of prepainted panels to avoid marring these with rivets or screws. It must be remembered, however, that as these cements are compounded essentially of synthetic rubber or resin, they are nonconductive, and electrical components which commonly use the frame as a ground will have to be provided with a separate ground wire.

Joints

If circumstances permit, a sandwich-type joint will usually give good results. This consists of a thin layer of rubber inserted between the two thicknesses of metal to produce a metal - to - rubber - to - metal joint. Adhesion between rubber and metal is excellent, and within the strength limitations of the rubber, a joint of this type will usually outperform a straight metal-to-metal joint.

Advantages

Although the scope of metal-to-metal adhesives is somewhat restricted with presently available materials, the possibilities for sticking metals to nonmetals offers almost unlimited opportunities. Almost without exception, the bonds obtained are stronger than the nonmetallic material, and provided this will stand the curing heat and can be adequately jigged, adhesives far surpass any other method of creating a permanent union. Fabrics, ceramics, paper, leather, plaster, rubber, plastics, wood, glass, and even portland cement concrete can be bonded to metal or to one another with complete assurance of 100% strength. Most of such bonds are waterproof and are highly resistant to attack by oils, acids, vapors, and fungus.

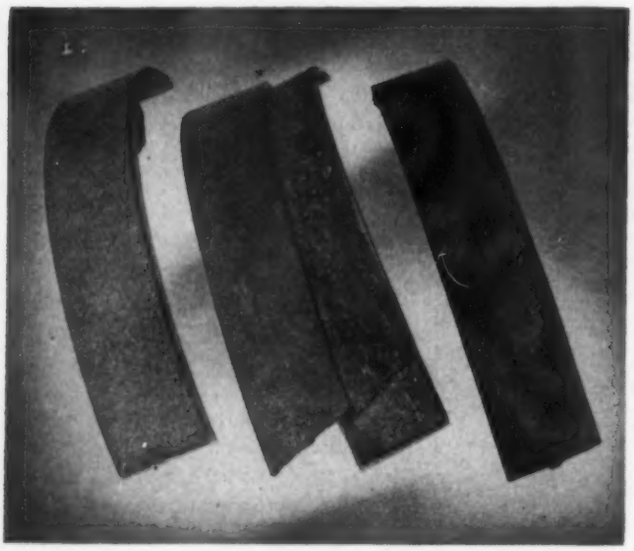
Attaching rubber, either natural or synthetic, to steel or other metals offers a vast field for improvements in product design and enormously simplifies the problems of producing resilient mountings for absorbtion of shock and vibration. The automotive industry offers many applications for this new technique in the manufacture of motor mounts, door seals, etc., but it can be used with equal success in countless other industries from the attaching of typewriter feet to the sealing of watertight doors on ships and lock gates.

For the industrial designer, an entirely new material is now available in the form of wood-metal laminates permanently bonded by the new adhesives. Combining the strength of steel with the beauty of wood, they are well suited for station wagon bodies and interior trim. They can be formed and bent almost as well as the bare steel, although sharp bends should be avoided, as these tend to split the fibres of the wood. Wood lined containers for explosives or other materials which should not be in contact with metal, can be fabricated by bonding panels of thin wood to the metal before bending it into the desired form. Similarly, wooden objects can be sheathed with metal for protection against burns and splintering.

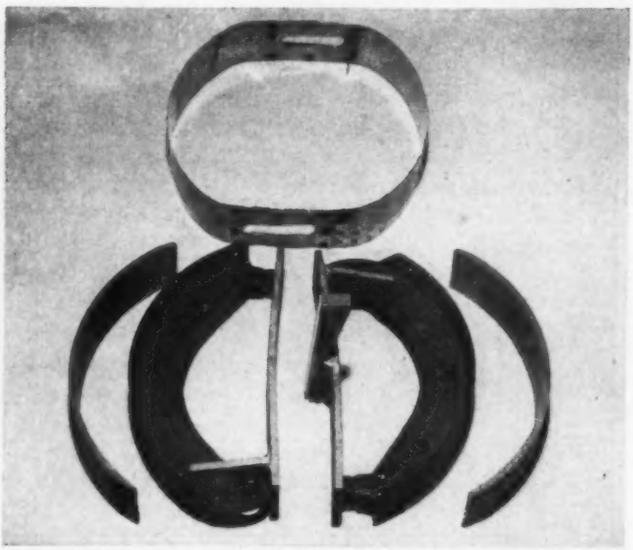
It is impossible to enumerate even a fraction of the other uses for the bonding technique, but one that should not escape mention is the attaching of linings to brake shoes. To the automobile user this is of immediate interest, as it puts an end to one of the commonest causes of screeching brakes, projecting rivet heads, eliminates the scoring of brake drums, and greatly prolongs the life of the lining, since this can now be used until it is worn down to a mere wafer.

Joint Preparation

Surfaces to be bonded must have good contact over their entire joint area, and should be free from burrs, waves or surface imperfections. Cleanliness of the surface is of the utmost importance, and for best results the recommendations of the cement manufacturer should be scrupulously followed. These vary somewhat



***BRAKE LINING** bonded to shoe (left). Lining sheared from shoe by 15,000-lb. load (center). Note that failure is in lining, not in adhesive. (Right), Lining charred to disintegration on dynamometer. Adhesive still holds*



***SIMPLE FIXTURE** for bonding lining to brake shoes. Steel band holds lining in contact with shoe, and pressure is applied by driving a wedge between two flat springs. Cement is cured by oven heat*

with different producers, but the procedures given below are typical of the type of cleaning desired.

For aluminum and aluminum alloys, the parts should be placed for from 3 to 5 min. in an alkali cleaning bath consisting of:

Sodium Metasilicate (Anhydrous)	3.6 oz.
Alkyl Aryl Sodium Sulphonate	0.4 oz.
Tap Water	1.0 gal.

The temperature of the bath should be 160-185 F. After removal the parts should be rinsed in running water and checked for absolute cleanliness. This can be done by noting whether water will form a continuous film over the surface. If the film is discontinuous, the work should be replaced in the cleaner and rerinsed, until a continuous film is produced. After this cleaning, parts should be placed in a solution of 5% by weight of chromic acid in 95% water. Temperature should be 140-160 F., and time of immersion 1-3 min. This should be followed by a cold running water rinse and a thorough drying by compressed air or oven.

Other Cleaners

Some manufacturers prefer an alkali cleaner consisting of:

Sodium Metasilicate	9 lb.
Alkyl Aryl Sodium Sulphonate	1 lb.
Tap Water	125 lb.

This is used at 140-150 F., and is followed by a hot-water rinse and oven drying. It is recommended for most metals, certain plastics, ceramics and glass. It is not suitable for unalloyed aluminum and magnesium as etching of the surface occurs. For pure aluminum, the use of a buffered alkali cleaner is suggested. This can also be used on the aluminum alloys. Such materials are Oakite 61 or 84A, and Sprex AC. Oakite 61 should be used in the ratio of 6 oz. per gal. of water at 160-180 F. for 5 min. Sprex AC is used in the proportion of 4 oz. per gal. of water at 180-200 F. for 15-20 min. After cleaning, surfaces must be thoroughly rinsed and dried.

An acid treatment can also be used for aluminum and aluminum alloys. This consists of dipping or sponging the surfaces for 10 min. at room temperature in:

Butyl Alcohol	4 parts by vol.
Isopropyl Alcohol	3 parts by vol.
Phosphoric Acid (85% technical grade)	1 part by vol.
Water	2 parts by vol.

The surfaces must then be washed thoroughly with hot or cold water and dried. A check must be made for neutrality by means of litmus paper or other pH indicator.

Some producers recommend preparing Alclad by degreasing with a solvent wipe or vapor degreasing, using trichlorethylene, acetone, carbon tetrachloride, or similar solvents. This is followed by immersing in an acid bath for 20 min. at 140-150 F., prepared thus:

Sodium Dichromate	1 lb.
Concentrated Sulphuric Acid	4.5 lb.
Tap Water	14 lb.

Cold and hot water rinses and drying then complete the process.

Another method consists of wiping with a clean cloth soaked in acetone, dipping in hot carbon tetrachloride, and then dipping in cold carbon tetrachloride and air drying.

When dipping is not practicable, surfaces can be rubbed lightly with steel wool and solvent, or sandpaper, emerypaper, or sandblast may be used. Metal so treated should be carefully flushed with water or wiped with solvent to remove all abrasive particles. Merely wiping with solvent is not generally considered satisfactory. If an anodic film is present it is not always necessary to remove it, although most manufacturers prefer to do so.

Carbon Steel

Plain carbon steel can be cleaned by immersing for 5-7 min. in a boiling cleaner made up of:

Sodium Carbonate	2.0 oz.
Sodium Hydroxide	2.0 oz.
Rosin Soap	0.5 oz.
Alkyl Aryl Sodium Sulphonate	0.5 oz.
Anhydrous Sodium Metasilicate	3.0 oz.
Tap Water	1.0 gal.

After thorough rinsing parts are pickled for 2-4 min. at 60-70 F. in the following solution:

Conc. Com. Sulphuric Acid Sp. Gr. 1.85	10% by vol.
Conc. Com. Nitric Acid Sp. Gr. 1.42	10% by vol.
Tap Water	80% by vol.

This is again followed by careful rinsing in cold water, and parts then go to a bright dip bath for ½-1 min. at 60-90 F. This bath consists of:

Conc. Com. Hydrochloric Acid Sp. Gr. 1.26	50-60 parts by vol.
Hydrogen Peroxide 30% (100 vol.)	2 parts by vol.
Tap Water	38-48 parts by vol.

Final step is to rinse in cold water, followed by hot water at 130 F. min., and then dry.

Alternate methods of cleaning steel are rubbing with steel wool or wire brushing, followed by wiping with solvent, or sand blasting and removing the grit by wiping or air blast.

Alloy Steel

Alloy steel surfaces are cleaned with a steel wire brush and rinsed or wiped with solvent, the process being repeated until a bright, smooth surface is obtained. In all cases scratches must be avoided, as a smooth surface will always produce a superior bond.

Magnesium is prepared by brushing with a fine wire brush (0.002-0.003-in. dia. wire) to remove the original chrome pickle coating, and then immersing for 5-10 min. in an alkali cleaner at 200-220 F. The bath may be either

Composition A:

Sodium Carbonate	2.0 oz.
Sodium Hydroxide	2.0 oz.
Alkyl Aryl Sodium Sulphonate	0.1 oz.
Tap Water	1.0 gal.

Composition B:

Tri-Sodium Phosphate	4.0 oz.
Sodium Carbonate	4.0 oz.
Alkyl Aryl Sodium Sulphonate	0.1 oz.
Tap Water	1.0 gal.

Parts are then rinsed in hot water, followed by cold water and a sec-

ond hot water, and finally dried.

Immersion in aqueous sodium metasilicate for 5 min. is also said to give good results. Dry sanding or steel wooling may be used instead of wire brushing, and castings may be lightly sandblasted and wiped or blown off.

Cadmium and zinc plated surfaces can be prepared by wire brushing or steel wooling until the coating is removed and a bright, smooth surface is obtained, and wiping or rinsing with solvent. Brass and copper may be treated in the same manner, but somewhat better results are obtained by light sandblasting followed by blowing off with compressed air.

Bonding Nonmetals

For wood, a light sanding is usually adequate, but this should be done with a very fine sandpaper to obtain a smooth surface. Deep scratches or a roughened surface are not desirable. The wood dust should be wiped off with a clean cloth, and the cleaned surface protected from contamination by dirt or fingerprints. As far as possible all cleaning should be deferred until the parts are ready for joining, regardless of what materials are being used.

Glass can be cleaned by wiping with a clean solvent such as acetone or benzine, or by dipping in a tri-sodium phosphate solution or a solution of sodium dichromate in sulphuric acid. The first method is usually preferable, since if either of the chemical solutions are used they must be carefully rinsed off and the surface dried thoroughly. In humid weather glass tends to accumulate a thin film of moisture, and this should be removed by warming slightly.

Thermosetting plastics may be degreased with a solvent such as trichlorethylene, or lightly sanded and cleaned with an alkali cleaner. Thermoplastic materials can be cleaned with a solvent or light sanding. Care must be taken in the choice of solvents that the surface of the material is not damaged.

The surface of rubber must be freed from all parting compounds by rubbing with light naphtha or by roughening the surface with coarse sandpaper. This is sometimes followed by cyclizing, which consists of immersing the rubber in concentrated sulphuric acid at 80 F. for 10 min., then thoroughly washing to remove all traces of acid, and carefully drying.

Other materials require no special preparation beyond seeing that they are free from grease or foreign matter. Leather should be roughened by sanding.

Just as there are many different methods of cleaning, so there are many different ways of applying the bonding material. These will vary with the different cements and the materials to which they are applied. Most cements are in the form of a liquid to be applied by brushing, spraying, dipping or roll coating. Others are in the form of a thin film or tape while still others are in the form of a liquid to be used in conjunction with a powder. The choice of product and method must rest with the user, and will depend to some extent on the nature of the work, production requirements, and facilities available.

Pliobond Process

This material is manufactured by the Goodyear Tire & Rubber Co., and distributed exclusively by United States Plywood Corp., Industrial Adhesives Div. In applying it for bonding two nonporous materials, it is necessary to remove all traces of solvent from the adhesive before bonding takes place. This is done by heating both adhesive coated surfaces according to one of the following schedules:

5-10 min.	at	300 F.
10-20 min.	at	200 F.
1-2 hr.	at	150 F.
8-24 hr.	at	110 F.
24-48 hr.	at	room temp.

After drying the parts are assembled in a hot press and bonded in a schedule of from 5 to 25 min. at temperatures of 225-235 F. with pressures ranging from 25 to 500 psi. Longer times, higher pressures, and higher temperatures usually yield better results, but the schedule selected will vary with the thickness of the material and its heat capacity. For metal to metal, 5 min. at 300 F. and 200 psi. has been found to give excellent results in most applications.

The use of a hot press is highly desirable, but if one is not available, the parts may be clamped together and placed in an oven. After the assembly reaches oven temperature it should be cured for:

15-30 min.	at	300 F.
20-45 min.	at	250 F.
1-2 hr.	at	220 F.

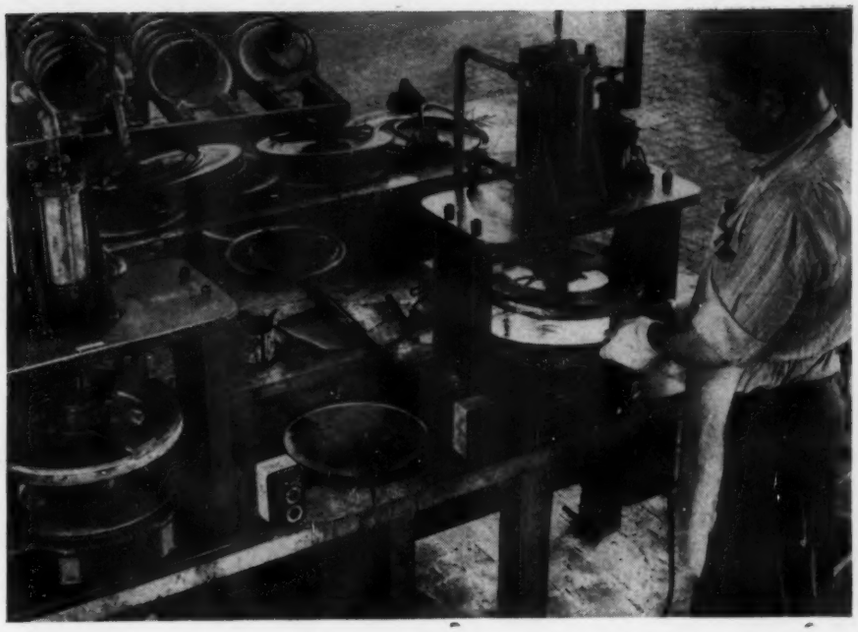
Any one of these schedules may be used, but the higher heat is preferred where it can be applied.

Strip Heaters Used

For certain applications, particularly for lap joints and for attaching small parts to larger ones, strip heaters can well be used. In this case the parts are assembled and a strip heater of suitable size placed over the joint. Ordinary C-clamps are used to bind the whole together. Hardwood or high pressure plastic strips should be used to distribute the pressure and to avoid damaging the assembly or the heaters. After applying pressure, heating is started and the glue line temperature raised to 300-350 F. This usually takes from 1½ to 2 min. Heat is then switched off and the assembly is permitted to cool under pressure.

For bonding wood to metal or other material, the hot bonding method described above is usually preferred, although in some applications, as in bonding wood to rubber, the reactivation method will produce better results. In this method the parts are prepared as before, but after the adhesive film is thoroughly dry the surface of the denser component is reactivated by wiping lightly with a soft cloth saturated with a solvent such as methyl ethyl ketone. This must be done carefully to avoid removing the film entirely. Other solvents may be used, but the more volatile the solvent the better the result, as slow solvents take longer to dissipate. After reactivation, the surfaces are joined immediately and held under pressure for from 15 min. to overnight, depending on the type of bond desired.

Maximum strength will be developed when the last trace of solvent has been removed. With very porous material 48 hr. will



***SYNTHETIC RUBBER** bellows are bonded to the upper and lower parts of ceramic land mines designed to defy detection by electric mine detectors. This was an important wartime application not possible without adhesives*

***AIR-OPERATED FIXTURE** for bonding a rubber seal ring to the search coil assembly of a mine detector. Electric heaters consist of resistance ribbon woven through holes in a mica ring and insulated by glass cloth*

usually be sufficient to obtain a bond commensurate with the strength of the material, but with material of low porosity a week or ten days may be necessary at room temperature. After bonding and removal of pressure, maximum strength may be achieved more quickly by heating at slightly elevated temperature. Heating overnight at 110-150 F. has been found advantageous in many cases.

For thermosetting plastics the hot bonding process is generally used, as these are impervious to the Pliobond solvent. On the other hand, thermoplastic materials lend themselves better to the reactivation method as their thermoplasticity usually precludes the use of heat.

Either the hot or reactivation process may be used with fabrics, but best results are obtained with the hot press. Ceramics and glass, on the other hand, should be hot bonded, but in this case the oven curing method should be used, as these materials are likely to crack on rapid heating.

Rubber can be bonded to steel or other materials by the reactivation method, but the hot bond may be used provided the pressures are not excessive. When excessive pressure is used, the rubber is distorted to an extent that the bond is put under constant shear when the pressure is removed, and an inferior bond results. After the adhesive is dried, the surfaces may be joined by pressing them with a hand roller or putting under a pressure of 25 psi. or less, for sufficient time to ensure removal of the solvent.

A specialized method has been developed for attaching fixtures and nameplates to plaster, concrete or wallboard. This consists of coating an area with the adhesive and allowing it to dry. The object to be attached is also coated and dried at an elevated temperature. While this is still hot it is pressed into place and held until it has cooled and made a joint.

Cyclewelding

The original Cycleweld process, developed by Chrysler Corp., Cycleweld Div., using only one cement, has now been modified by the development of two additional processes: Cycle-Bonding — low temperature, and Cycle-Bonding — medium temperature. In either case, however, the original Cycleweld cement is first used on metal surfaces to obtain proper adhesion, and intermediate cements are then applied in the latter two processes.

For the basic process, both surfaces to be bonded are coated with a slow-drying cement and allowed to air dry for 30 min. This is followed by baking at 180 F. for an additional 30 min. to cure the cement. The components may remain in the cured condition until convenient for assembly, but the surfaces should be protected against contamination by dirt or grease. At the appropriate time the elements of the assembly are clamped in fixtures provided with cartridge heaters at the glue line, or placed in a heated hydraulic press for the curing process.

Maximum bond strength is developed in 15 min., and the optimum temperature ranges between 325-335 F. However, where loads are light or the material strength substantially lower than maximum bond strength, curing time may be as short as 3 min. and the temperature may vary between 250 and 335 F. Unless production requirements are such that the shorter time is necessary, it is better to operate on the longer cycle. Clamping pressure does not affect the curing, but must be adjusted to suit the limitations of the material and insure full contact of the mating surfaces. Recommended pressure for joining metal to metal

is 300 psi., metal to hard wood, 200 psi.; metal to soft wood, 150 psi.; and metal to rubber, 25 psi.

When conditions are such that this simple procedure cannot be readily applied, the Cycle-Bonding process may be used. In joining surfaces with a commercial finish, for example, the cement does not flow readily during the curing process so as to fill in minor surface irregularities, and heavy pressure would have to be applied to secure intimate contact. This may set up stresses which would induce joint failure when the pressure is removed. When joint surfaces lie in different planes, and when expensive and elaborate tooling would be required to furnish the necessary bonding pressure, or when the normal Cyclewelding temperatures and pressures would be injurious a different procedure is used.

Cycle Bonding

For low temperature Cycle-Bonding, as in a wood-to-metal joint, the metal component is coated with Cycleweld cement and cured in the usual manner. Both parts are then coated with the special Cycle-Bond cement and brought together at pressures up to 200 psi. and at a temperature between 140 and 200 F. This avoids warping of the wood by residual stresses, and the special cement has the property of filling in minor surface irregularities. This process can be used to advantage in joining metal to rubbers which must remain elastic at sub-zero temperatures but cannot be heated above 150 F. without harmful effects.

When pressures cannot exceed 30-90 psi., but temperatures up to 300 F. are permissible, the medium temperature Cycle - Bonding process may be used. Parts of heavy gage, odd shape, or considerable surface irregularity can be joined by this process, provided both can be coated with Cycleweld cement and cured. Cycle-Bond cement is then applied and the parts brought together under light pressure and cured at 300 F. Joints made in this way are somewhat thicker at the glue line than those made by Cyclewelding, but the higher modulus of the cement offsets the weakening that would otherwise result.

Redux Process

One of the first synthetic resin adhesives designed for the gluing of metals, Redux was developed in England by Aero Research, Ltd. and is now produced by the Resinous Products & Chemical Co., Philadelphia, which has brought it to a high degree of perfection.

The process is based on the use of two separate components; a low viscosity liquid, and granular powder. The latter is fully stable, but the liquid has a storage life of only about 2 months. Under refrigerated storage, or upon aging, it tends to separate into two layers and must be agitated to restore it to its original form. If it has been exposed to unfavorably high temperatures and remains in two layers or as a milky emulsion at room temperature, the addition of about 10% alcohol by volume will usually restore it to its homogeneous state. If the separated condition persists after the addition of the alcohol, the liquid must be discarded as unfit for use.

For metal-to-metal bonding the liquid is applied uniformly over both surfaces in the amount of 20 - 25 lb. per 1000 sq. ft. Coating one surface only will also produce good results, and may be done where cost is an important factor. As soon as possible after the liquid is applied, and while it is still wet, the powder is sprinkled over the surfaces to give uniform coverage. A hand-operated flour sifter serves well for small surfaces; for large areas an ordinary window screen or some similar arrangement is recommended. The ratio of powder to liquid is not critical, but sufficient powder must be used that no wet areas remain exposed. Excess powder is removed by inclining and tapping the metal, and may be collected for reuse.

Following application of the powder, the surfaces are permitted to air dry for at least 5 min. For maximum bond strength at elevated temperatures, the air drying period should be from 8 to 24 hr., and may be prolonged up to several days if production schedules require this. For bonding, the surfaces are brought together under heat and pressure to convert the adhesive to its final form. During this process the composition goes through a stage of thermoplastic flow, during which the two components become intimately mixed, then fuses to produce the bond.

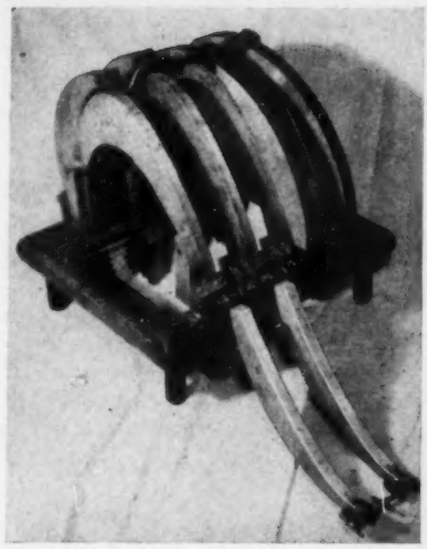
Bonding time and temperature will vary with the material and the thickness. For 0.064-in. S.T Alclad, 15 min. is required at 300 F.; 20 min. at 280 F.; 30 min. at 260 F.; or 50 min. at 240 F. The thickness of the adhesive film should be brought within the range of 0.002 to 0.006 in. to insure optimum strength in the joint. When shims are used to control film thickness, pressure of 200 psi. will usually be adequate, and for joints of small area 50 psi. will suffice. Where no shims are used, regardless of the area, a specific pressure of 500 - 800 psi. is required to reduce the film to optimum thickness. It is not necessary to cool the joint under pressure provided it is not stressed during cooling.

If metal is to be applied to both sides of a wooden core, or wood to both sides of a metal core, Redux liquid and powder are applied to the bonding surfaces of the metal. Redux liquid or Amberlite PR-14 is applied to the wood, but no powder is used. The assembly is then bonded in a hot press at 300 F. for a minimum of 15 min. at 200 psi. Bonding time requirements will depend to a large degree on the thickness of the wood, and must be determined experimentally. The moisture content of the wood should not exceed 12%, and preferably 6 - 8%.

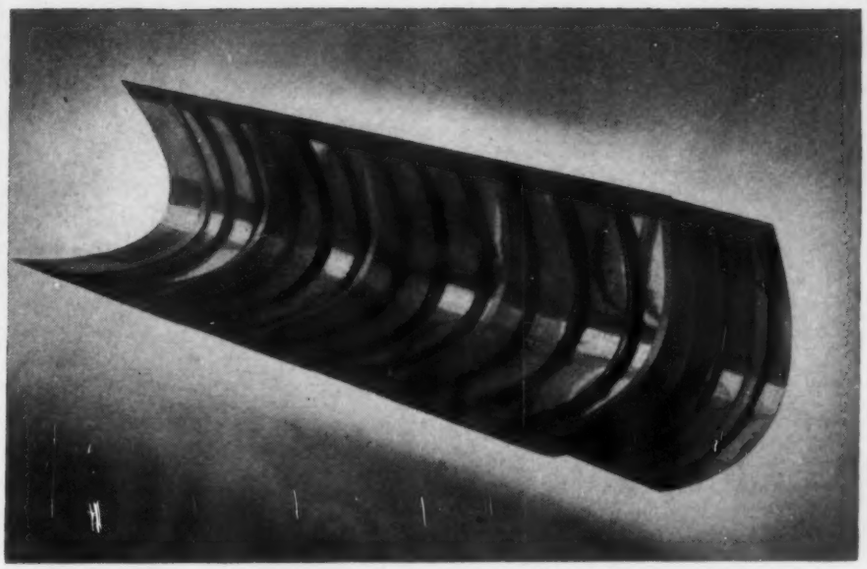
Low Temperature Bonds

If lower bonding temperatures are desirable, as in the rubber bag process for curved assemblies, the method is similar except that the wood is coated with an alcoholic solution of equal parts of Amberlite PR-14 and alcohol and allowed to air dry for 2 hr. or longer. The assembly is then bonded at 240 F. for about 30 min.

For cold or moderate temperature bonding, the metal is coated



***BONDING JIG** for assembling airplane leading-edge skin to aluminum stiffeners. Clamps are spring-loaded for equal pressure application*



***LEADING-EDGE SECTION** of an aircraft wing viewed from the inside and assembled by bonding the skin to the stiffeners with adhesive*

with Redux liquid and powder, covered with a copper caul and cured for 15 min. at 300 F. under light pressure. All loose powder is then removed by brushing with a stiff wire brush. The wood surfaces are then coated with a mixture of 70 parts Uformite CB-552 and 30 parts water. Bonding is effected under pressure at room temperature for 4 - 6 hr. If temperatures of 140 F. or higher are permissible, Amberlite PR-75-B can be used in place of the Uformite, and clamping time reduced to 4 hr. This can be still further reduced if higher temperatures are employed.

Where it is desired to bond metal to only one side of a wooden panel it is necessary to equalize the strains set up by the different coefficients of expansion. This can be accomplished by the use of an interlayer of 8 oz. duck. The duck is first bonded to the metal at 300 F. for 15 min. at 100-200 psi., and then bonded to the wood in a second operation, using Uformite CB-552 or Amberlite PR-75-B.

Redux is excellent for stainless steel but is not suitable for joining copper and its alloys.

Metlbond Method

Developed and produced by Narmco, Inc., San Diego, and used extensively by Consolidated Vultee Aircraft Corp., this adhesive is available in several different grades for various purposes. For metal adhesion, however, types M3c and N2 are generally used. The former is a combination of synthetic rubber and plastics, and is used for obtaining high strength bonds and good elastic properties on metal-to-metal joints that can be cured at pressures of 100 psi. or more. The N2 type is a phenol-formaldehyde resin modified to obtain greater flexibility, and is used when lower curing pressures must be employed. Its bond is not quite as strong as the M3c type and is lower in elasticity.

Both types possess certain disadvantages which may be overcome by forming a combination of the two in alternate layers. The elastic M film is uniform and the N film corrects irregularities from imperfect matching. The process is known as Quadrabonding, or the joining of four surfaces, and results in a film requiring low curing pressure but having high elastic properties. When extremely low curing pressures, i.e., from 1 to 10 psi. must be employed, optimum results are obtained by an interlayer of fiberglas cloth which serves as a path for the escape of gases evolved when curing at less than 10 psi.

Metlbonding may be applied to most materials, although it has been found that when used on glass the joint will fail, if exposed to sunlight. On the other hand, the adhesion to transparent thermosetting materials is not affected by sunlight. Special types are available for thermoplastics which will not withstand the normal 320 F. curing temperature.

Type M3c is usually applied by spraying in smooth, even layers with a short drying time between each coat. The disappearance of the surface gloss may be taken as an indication that the film is reasonably solvent free. The film should be built up to about 0.005 in. on each surface. The remaining solvent is then removed by drying at room temperature for 20 min., followed by a 20-min. oven dry at 160 F. Parts are assembled and cured under a minimum pressure of 100 psi. Lower pressure will not produce sufficient flow to fill all inequalities in the surface. Curing temperature is 320 F. ± 20° for 20 min., exclusive of the time required to bring the assembly up to temperature.

Combination bonds are made by brushing two or three coats of N2 over each M3c surface after this has been oven dried. A drying period of 5-10 min. should be allowed between each coat, and a final air dry for a minimum of 20 min. followed by an oven dry of 35 min. at 200 F. The dried film of N2 should be approximately 0.003 in. thick.

Parts to be bonded are assembled and cured for 25-35 min. at 320 F. and 25 psi. minimum.

When brushing is not convenient, the M3c type may be applied as a prepared tape or sheet, although the liquid form is generally preferred. To use this, the required shape is stamped out of the cured M material. The surfaces of the parts to be bonded are given two coats of N liquid, dried, and the M film sandwiched between them. Curing is done at 250 F. for 75 min. at a minimum pressure of 100 psi.

For rubber-to-metal joints the MN procedure should be used, but the N liquid need be applied only to the metal, and a pressure of 10 psi. is adequate.

Bonds made by this process should not be subjected to service temperatures in excess of 300 F.

Plycozite Bonding

Composed of both thermoplastic and thermosetting resins dissolved in a solvent, Plycozite adhesive is a product of the Glen L. Martin Co., Baltimore. When dried and cured, it becomes thermosetting, resistant to solvents, and of high strength. Metal-to-metal joints have shown a shear strength of from 8000 to 10,000 psi. at room temperature, and 600 psi. at 150 F. It is suitable for bonding virtually all types of materials.

Pressure during the curing cycle must be sufficient to produce full contact of all mating surfaces and to cause flow of the adhesive. 150 to 500 psi, for metal-to-metal produces satisfactory bonds, with the higher pressures used for thick gages or large bonding areas. For most work 200 psi. is usually preferred. Prefitting of the metal surfaces before application of the adhesive is advisable, as this tends to show up any surface imperfections, which may then be corrected. A resilient pressure pad may be used when imperfect alignment of the platens occurs.

Curing temperature of 300 F. produces optimum results, with the time under pressure not less than 10 min. nor more than 20 min. When heat conductivity of the metal is high, however, satisfactory bonds can be obtained in 5 min. Satisfactory bonds may also be obtained in shorter times with temperatures as high as 400 F. Joints so made show higher shear strength at 150 F., but no improvement at room temperature.

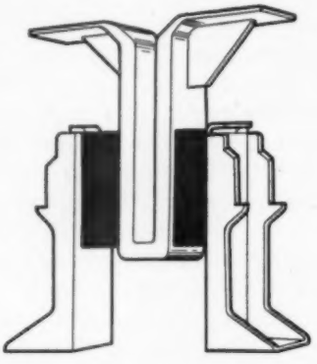
The thickness of the glue line is not critical, but as very thin films frequently lack complete contact, the cured film thickness should be between 0.010 and 0.014 in.

For continuous nonporous surfaces such as metal and plastics, two heavy coats of adhesive should be applied with a soft brush. Vigorous brushing should be avoided, as this will produce an uneven coat due to the rapid drying of the solvent. Application may also be made by roller coating, spreading or spraying. With the latter method it is suggested that the adhesive be thinned 1 part to 1½ parts of solvent, and that two double spray coats be applied. A double spray coat consists of two heavy passes made at right angles to each other. Whichever method is used, an air drying period of 30 min. should elapse between coats, and 1 hr. or longer after the final coat. Parts are then force dried 1 hr. at 150 F.

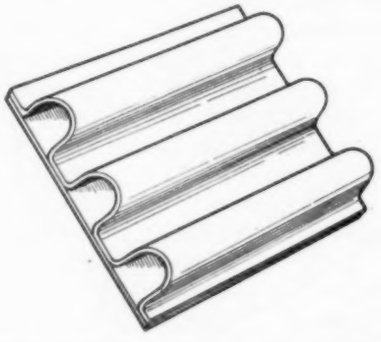
To remove all final traces of solvent and partially cure the adhesive, it is desirable to heat the assembled parts at the curing temperature but without pressure. Following the preheat, the bond is formed under heat and pressure sufficient to insure contact over the entire area and to cause flow of the adhesive. Any of the following will produce satisfactory results:

Preheat Time Minutes	Curing Time Minutes	Preheat & Curing Temp. °F.
1	3	400
2	4	375
3	5	350
5	8	325
8	10	300
30	70	275

For metal-to-wood joints the application of Plycozite is the same as for metal-to-metal, but best results are obtained by using an oven drying time of 2 hr. at 150 F. open assembly, followed by a cure under pressure of 4 hr. at 250 F. However, where the bonding areas are small and the resultant stresses due to unequal coefficients of expansion are not sufficient to cause warpage, the oven drying time may be cut to 1 hr., the preheat to 8 min., and the curing to 10 min. at 300 F.



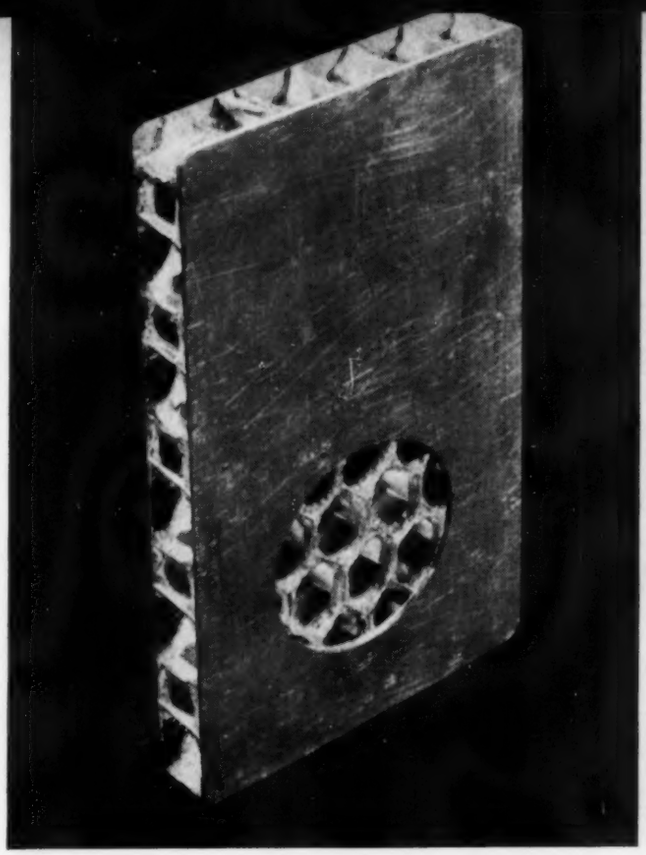
***SKI PEDESTAL** for aircraft landing gear is a typical example of bonding rubber to steel. Although used at very low service temperatures the rubber will not separate from the steel under 3500-lb. load*



***DEEPLY CORRUGATED** metal bonded to a flat sheet produces a high-strength, lightweight structure with a smooth, unbroken face on one side suitable for flooring or paneling*

Honeycomb Structures

One of the outstanding applications of Plycozite has been in the manufacture of honeycomb panels for aircraft doors, flooring, bulkheads, etc. The core consists of hexagonal cells of metal, plastic, or other material securely bonded together and sandwiched between layers of metal, wood, or plastic. It is extremely strong and rigid, low in cost and unaffected by climatic changes. Metal cores appear to be the most practical, and offer many uses in the building trades, furnishings, and in the transportation field. Completely bonded with Plycozite adhesive, the 800 cells per sq. ft. unsinkable.



***ALL-METAL HONEYCOMB** structure completely bonded with thermosetting plastic adhesive. Circular piece is cut away to show core construction. Both core and face plates can be made from aluminum foil, wood, plastic or other material*

***PORTABLE KIT** for repairing tears in honeycomb structure consists of precured patches, an electric heater, and a jackscrew with a retaining arm held by straps and rubber suction cups. Time alarm is also included*

An ingenious method of making repairs in torn honeycomb panel surfaces, such as might be caused by the corner of a heavy crate, has recently been developed. The hole in the core structure is filled with suitable synthetics, and the surface of the panel thoroughly scrubbed with steel wool and solvent. A coat of adhesive is applied to the surface and a steel ring, ¼-in. high and of the same ID. as the patch to be used is placed over this. A portable electric heater is then placed on the ring and the adhesive is cured for 20 min. at 300 F. After removal of the heater, the surface is allowed to set for 10 min. and then a metal patch, precoated with cured adhesive, is placed over the hole. The heater is replaced directly over the patch and pressure applied at about 10 psi. by means of a jackscrew. Curing takes about 20 min. at 300 F.

Plastilock Adhesives

An organic adhesive developed by the B. F. Goodrich Co., Plastilock 500 has been found eminently suitable for the joining of metals and other materials. Surfaces to be bonded by this method must be thoroughly cleaned, but it has been found that a buffed or blasted surface is of no advantage and should be avoided. No particular care is required to protect the surface from dust or other fine dirt, although particles with a diameter comparable to the bond thickness must be avoided.

The adhesive can be applied by brushing, dipping or spraying, but care must be taken not to brush out the cement. It should be allowed to flow evenly from the brush. Two coats should be applied to each surface, each coat being allowed to dry for 1 hr. at room temperature, or for a shorter period at a higher temperature. The properly dried film is fairly hard and only slightly tacky. To remove completely all solvent and to start curing, the parts are then preheated, either separately or assembled, but with no pressure applied.

Following the preheat, the joint is formed under heat and pressure. Almost any temperature will form a bond, provided a sufficient amount of time is allowed, but bonds cured at high temperatures

Effect of Preheat and Curing Temperature and Time on Plastilock 500 Bond Strength

Preheat Time Minutes	Curing Time Minutes	Preheat and Curing Temp. °F.	Shear Strength (psi.) Room Temp. 24ST Alclad
30	45	250	1620
25	30	280	1920
20	25	300	2175
13	18	325	2360
10	12	350	3300

for short time give the best results. Any of the schedules given in the accompanying table will be satisfactory, but it should be noted that the shear strength decreases as the temperature of the cure.

Pressures will vary to some extent, but 50 to 100 psi. appears to give the best results. At very low pressures the bond formed will not be continuous, but within the range given a complete layer of cement about 0.005 in. thick will result. Higher pressures tend to squeeze out the cement, decreasing the film thickness and strength.

The method of application to materials other than metals is the same as for metals, and high strength values can be obtained on virtually any material. Plastilock is not well suited as a commercial plywood glue because of the time and temperature necessary to form a sound bond, and its resistance to water is poorer than that of some of the better wood glues. Under dry conditions, however, wood joints will invariably fail by rupture of the wood.

High Shear Strength

Shear strengths of 3300 psi. and tensile strengths of 8000 psi. have been obtained on aluminum alloys at room temperature, with some reduction at extremely low temperatures or those in excess of 160 F. On other materials shear strengths range from 4800 psi. on spring steel to 600 psi. on zinc and untreated magnesium alloy. Gasoline has little effect on this adhesive. Water and salt sprays have little effect on metal or plastic bonds but destroy glass bonds in a few hours. Bonds will not resist alcohols and ketones.

Of the same general type are two other Plastilock cements designated 601 and 602. The former is in the form of a tape gaging between 0.012 and 0.015 in., and the latter a liquid cement. The advantage of the tape is that the fire hazard resulting from the solvent is eliminated as also is the usual messy application. The thickness of the bonding medium and the subsequent over-all thickness of the assembly is also easier to control. The solvent type 602 has the advantage over 500 that it dries much faster and the preheating procedure is not necessary. Both tape and liquid types give equal bond strength.

Complete information on the 600 series is not yet available, but it can be stated that the new material has improved resistance to water and solvents, improved impact strength, better resistance to higher temperatures and greater ease of application. It was developed originally for bonding brake linings to brake shoes for the automotive industry, but can be applied to most other metal bonding jobs.

Reanite

Based on the use of Reanite cement, the Reanite bonding process has been developed by U.S. Stoneware, and is available as either a liquid or a tape. A single coat is applied to each side of the joint and allowed to air dry for about 1 hr. A second coat can be used if thicker films are desired, but is not usually necessary. After drying the surfaces are pressed together and heat is applied. The amount of pressure needs to be only enough to hold the surfaces in intimate contact and to permit the adhesive to flow as heat is applied. Curing may be by steam, hot air, hot plates, ovens, or electronic heating, and time will vary fom 15 min. to 2 hr.

The process is particularly suited to bonding rubber to metal, and adhesion strengths up to 1200 psi. tension can be obtained. Stronger bonds are normally obtained when the rubber is in an uncured state, but excellent results can be obtained with the vulcanized product. It is also suitable for bonding all types of metals and other substances. It is noncorrosive and remains unaffected through a temperature range of —50 to +300 F. Fresh and salt water have no effect on bond strength, but the material is attacked by certain solvents and hydrocarbons.

Other Processes

Space limitations make it impossible to give complete details on all the other materials available from different manufacturers, but their method of application is similar to those described above and consists essentially of coating the surfaces with adhesive, drying, and curing at various times and temperatures.

In all cases, cleanliness of the surfaces to be joined is absolutely essential, and a means of applying heat and pressure must be provided. When liquid cements are used the solvents are usually of a highly inflammable nature, and adequate precautions must be taken against fire. Some of the solvents are also toxic and should not be applied in closed areas without a properly designed ventilating system.

The use of cemented joints is increasing rapidly, although there are many applications that have not yet been explored. Among their advantages is that a clean, continuous joint is obtained, with no local stress concentrations to encourage buckling. Easy production methods are possible, air- and liquid-tight joints are obtained, and the method is applicable to materials such as wood, paper, plastics and other substances which cannot be fastened by other methods. Against these advantages is the fact that production tooling is different from that now in common use, and no method is known for determining the soundness of finished joints. Process control is essential. Nevertheless in a great many cases, the advantages outweigh the disadvantages, and the cemented joint merits consideration as a tried, practicable method of joining materials in direct competition with other established methods.

We acknowledge

The generous cooperation given by the following firms in the preparation of the material for this report:

Chrysler Corp., Cycleweld Div.
Consolidated Vultee Aircraft Corp.
E. I. Dupont de Nemours & Co., Inc.
Durite Plastics, Inc.
B. F. Goodrich Co.
Goodyear Tire & Rubber Co.,
Glenn L. Martin Co.
Narmco, Inc.
Resinous Products & Chemical Co.
U.S. Plywood Corp.
U.S. Stoneware.

ROUND TABLE

Does A Raise Raise Output?

"Al, I don't believe most people are overpaid. In fact, I don't blame a guy for wanting more money. But it seems to me that the more money they get, the less they do."

"Well, Ed, I don't see it that way. I think that the plants paying the most money get the best employees."

"That isn't exactly what I mean. What I'm talking about is that my boys, like all the others, just got a raise. They are making about 30% more money than they made prewar, but in place of being more efficient they are less."

"That's easy, Ed. It only proves that money is not the incentive for efficiency."

"Wait a minute! You mean to tell me that incentive pay doesn't lead to more production?"

"No, setting a goal of more money for more output will stimulate production, but the incentive is not present when you set up the system or when the man gets the check; it is only present when he spends the money."

"I don't follow you, Al. What's the difference?"

"The difference is that most employees accept raises as something due them for present efforts. Good men do a good job because they want to."

"You're all wet! The only thing my men ask for is more money."

"That's probably true, but only because they don't have any other way of asking for job satisfaction."

"Al, are you trying to tell me all we have to do is keep them happy and we won't have to worry about efficiency or raises?"

"No, all I'm saying is that money alone will not increase efficiency. You see, Ed, when you assign a job to a man, the factors that determine how quickly and how well he does the job are first the skill or 'know how,' second his interest or desire to do a good job. Whether you pay him $1.50 an hour or $1.75 an hour has nothing to do with increasing his skill. More money may be the incentive which causes him to work harder, but it doesn't necessarily increase his interest."

"The only trouble with your point, Al, is that the proof is on the other side: For years, as wages have gone up production has gone up."

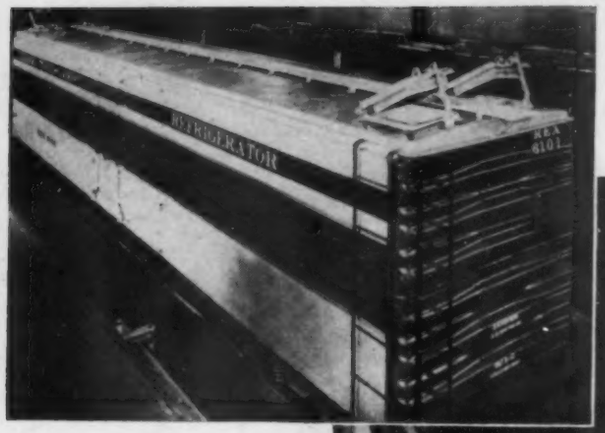
"That's where you're wrong. Wages don't make production go up, but increased wages are the result of more efficient production. You know as well as I do that it's the improved equipment that has increased our production, not the paying of more money. Physically, men work harder and produce less on old or poor equipment."

"Al, you still haven't told me why my efficiency is not where it should be."

"Ed, I wish I could, but it is a combination of things, with money a very small part. It depends on how a man feels about his job, how well he knows his job, and how he feels about the company. If you can increases the job satisfaction of your group, you will increase the efficiency."

HOW CAN EFFICIENCY BE IMPROVED, *if not by wage increases? Is general satisfaction with company and job more important than money? What are your ideas on this subject? Your experience can help others. Discussions of earlier topics appear on later pages.*

FREIGHT CAR



Passenger-car trucks, with both coil and elliptic springs, roller bearings and twin brakes, permit these low-alloy, high-tensile steel refrigerator-express cars to roll in high-speed trains. Built by American Car & Foundry, cars are 51 ft. 10 in. long over ends, will carry 50 tons or 2650 cu. ft. (max.). Bodies weigh 51,400 lb., trucks 27,800. Ry. Express ordered 500, Atlantic Coast Line 50

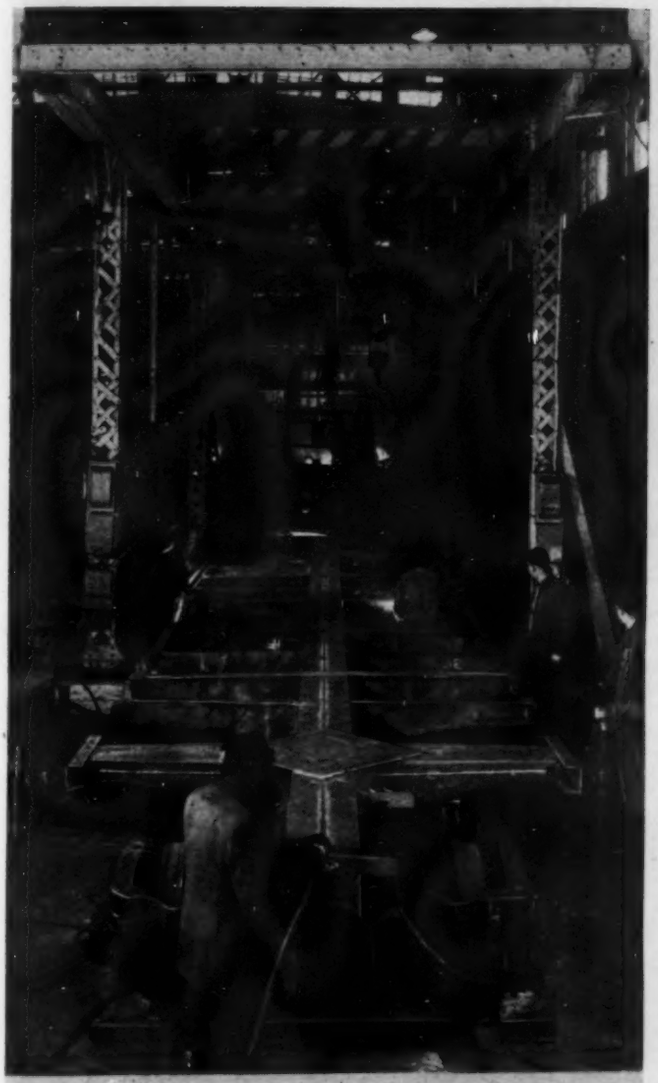
UNDERFRAME IS SUBASSEMBLED

1 **Center sill**, preassembled, is lowered (upside down) on centers into underframe jig by electric hoist-rotators in end guillotines. Side sills are in position. Air-operated clamps, like the pair in foreground, hold it while several welders work simultaneously. Frame is lifted gently to avoid disturbing part-welded assembly, inverted, and completed

2 **Underframe** is held by two weld positioners for rotation so all hand welds are made downhand. This setup, and all others, is readily adjustable for varying underframe length. Electric hoists provide local handling

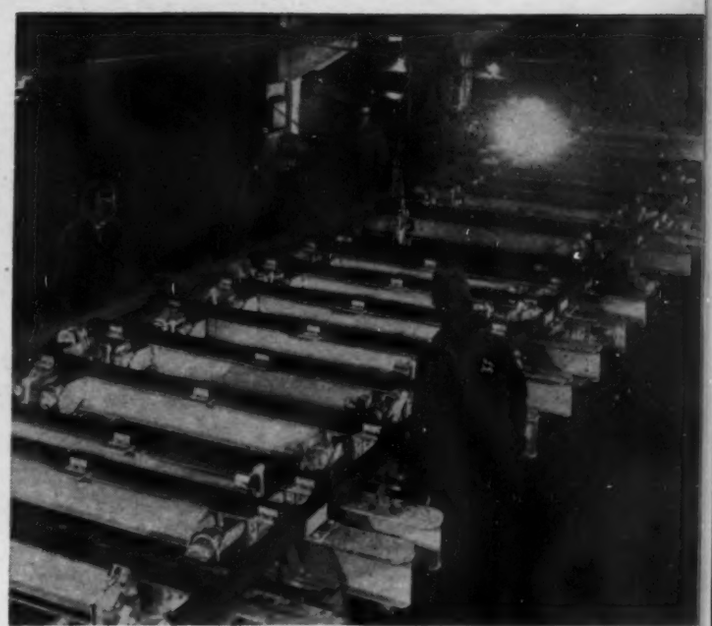
• ***ACF installs 24-per-day line for all-welded steel cars at Chicago, including automatic submerged-***

FABRICATION FIXTURIZED

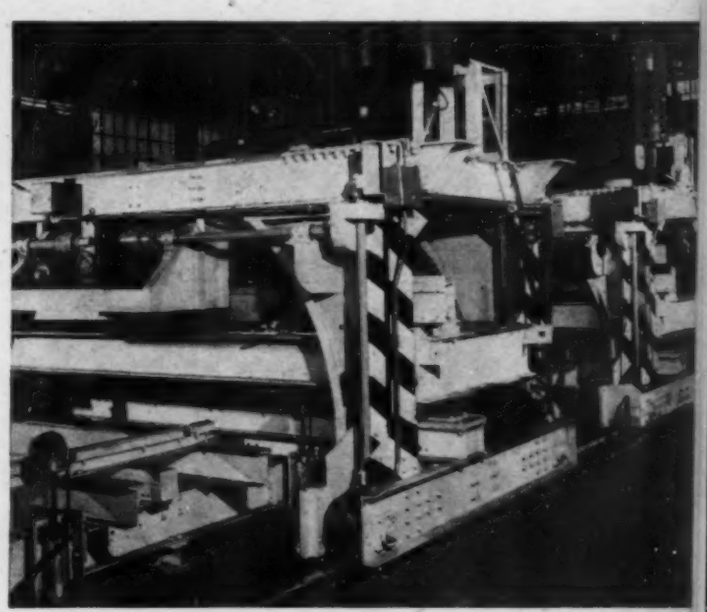


3 **Roller-bearing trucks** (below) support the underframe for welding of miscellaneous parts, insertion of coupler and draft gear, flash grinding and similar finishing operations. In contrast to normal practice, underframe built in jig is accurate to within very close tolerances

SIDE FRAMES ARE PREFABRICATED

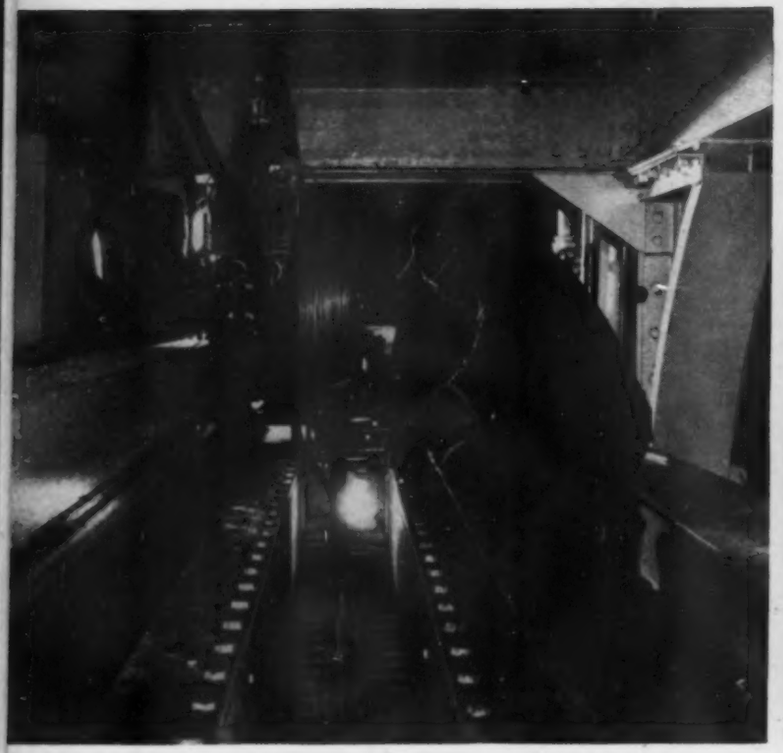


4 **Sides** are also jig-assembled. Here precut side-frame members (angle sills and channel sideposts—dark in color) are in position and held by pneumatic clamps for welding. After this, the frame passes along on pneumatic-lift rollers to next position, where it is held by lever clamps, side sheets applied and tacked by handwelding



5 **Gantries** carry automatic, submerged-arc welding heads to weld vertical (as erected) seams in side sheets, three at a time, or both longitudinal seams at once. Gantries are motorized to run on rails parallel to, and outside, the fixture, which has pneumatic elevating cylinders carrying rollers (lower left) on which the side may be moved

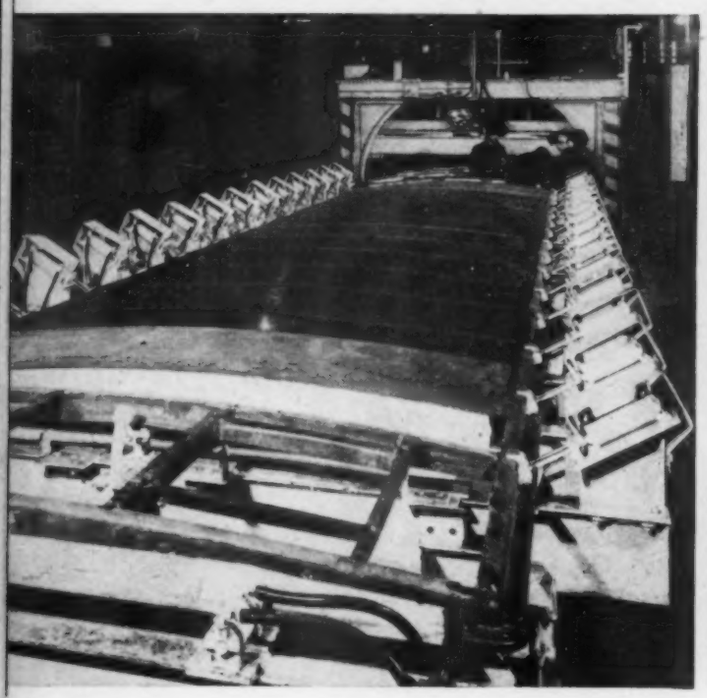
arc welding units, special fixtures and clamps, with prefabrication and fixture adjustments for size •



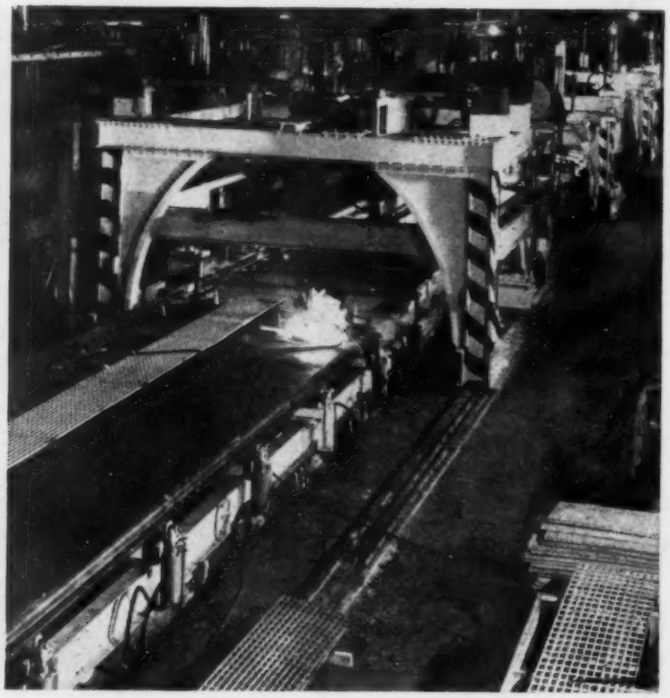
6 **Side sheets** are welded to sills by submerged arc in an earlier position on the same fixture at 120 fpm. Welding heads travel simultaneously along a beam which also carries group-actuated hold downs. Only riveting is of door posts, door rails, accessories. Here cross-gantry welds side sheets to sidepost

7 **Studs** to secure woodwork to frame are applied to the sideposts with a Nelson stud-welding gun. Pad Fiberglas insulation is then applied, wood inside frames set over it, and the side is ready for final assembly. Interior finish is shown in Step 10 (photo at right)

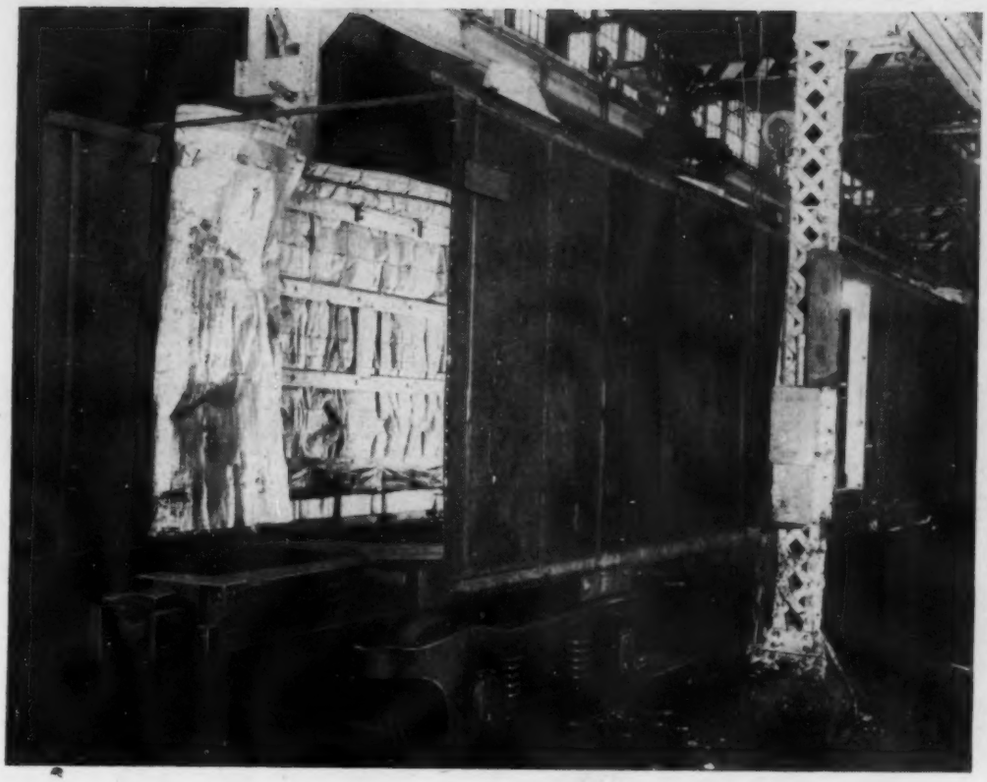
FREIGHT-CAR ROOFS ARE SUBASSEMBLIES ALSO



8 **Roof** frame members are set in the jig and held by pneumatic clamps for downhand welding. Roof sheets are applied and positioned by toes on clamps for submerged-arc welding just as sides are assembled, except head travels in roof arc, guided by a follower wheel running over roof sheets at weld location



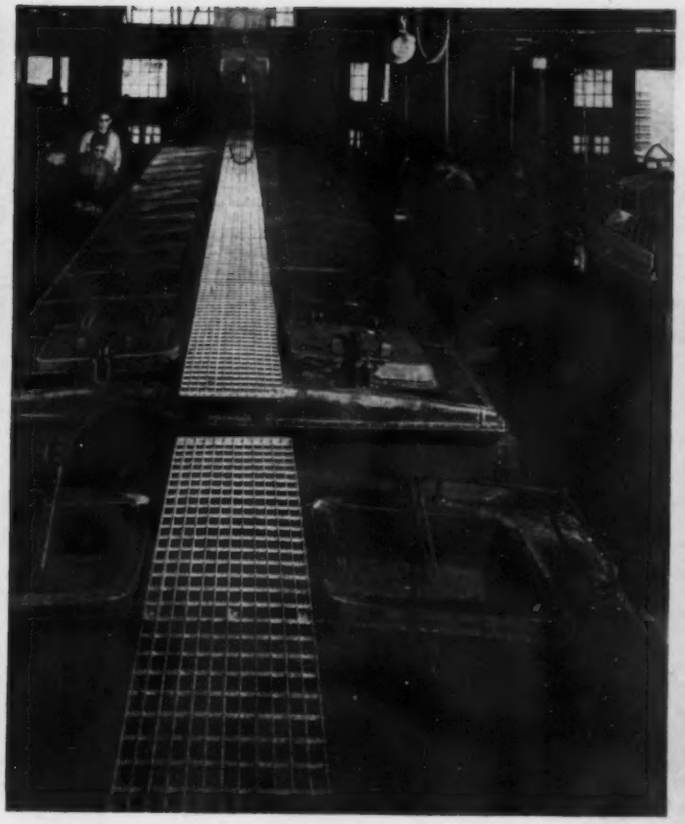
9 **Running-board** lugs and hatch frame are hand welded in place after the roof leaves the seam-welding gantries (background), then running board is welded in place. Note pneumatic-lift rollers on fixture. Automatic welding is done by the Lincolnweld hidden-arc dc. process, with a bare metallic electrode fed through a granular flux



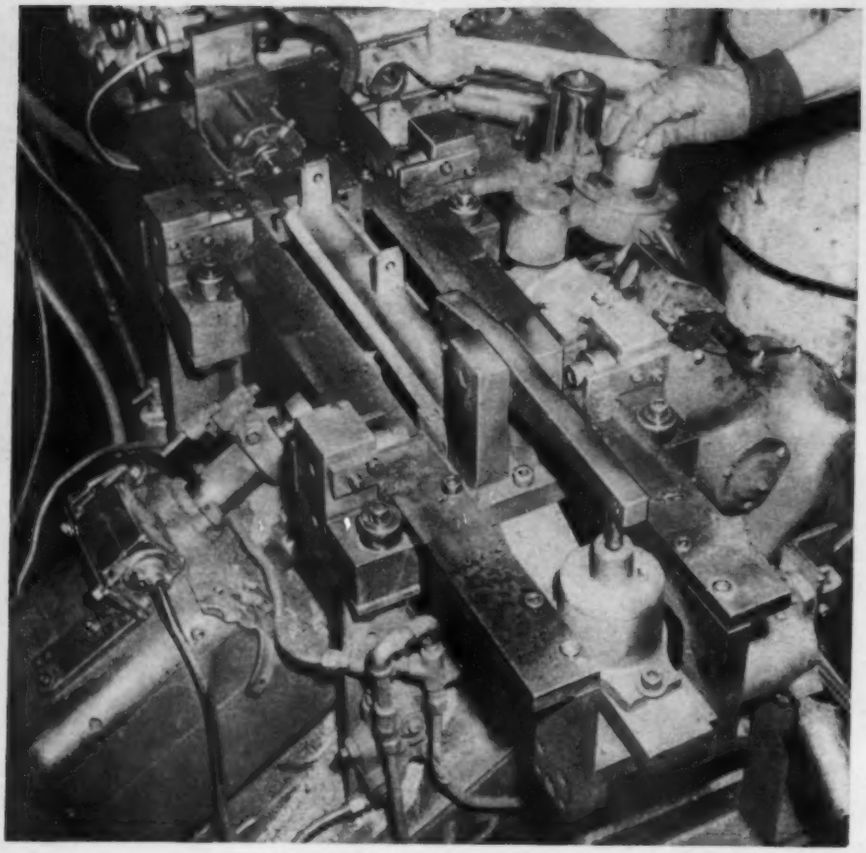
FINAL ASSEMBLY IS SIMPLE

10 **Car sides** are set up on the underframe assembly with top spacers. Electric hoists on a short-span bridge support the sides before bolting. Sides are riveted to side sills. Here interior wood framing and insulation mentioned in Step 7 may be seen rolled back to clear end

11 **Pre-assembled ends** are fitted in place and bolted preliminary to riveting as shown here. After riveting, insulation and wood end frames are installed. These ends, plus lock kingpins, prevent climbing as well as telescoping in collision. Side doors move out on gooseneck rollers, then slide endwise (rather than swinging) to clear high platforms



12 **Roofs** are set by crane and riveted (for ease of removal in repair) to side flanges by pneumatic squeeze-riveters supported by balancers. Portable electric forges run along tracks behind a walkway which permits work to be done at waist height. Later steps include flooring, fitting of ice bunkers, fans and swing-up floor racks to outfit car



Controlled by a master switch, two Kingsbury single-spindle units operating at 5200 rpm. drill a series of 43 holes on each side of oven burner

DRILL JIGS

Speed Output of Stove Burners

By WALTER RUDOLPH

BY FIXTURIZING many of its drillpress operations, Odin Stove Co., Erie, Pa., has more than doubled the productive capacity and efficiency of the drilling department. Experiments were begun shortly after the war and are still going on, in conveyorized production of kitchen ranges.

Two of the subassembly parts upon which the drillpress work has been extensively studied and improved are the oven and top burners. Both were formerly drilled after being manually placed in awkward jigs and moved around on drillpress tables. The oven burner requires 86 side port holes, 10 end port holes, two holes for the hanger rod and one for the lighter tube holder. These were formerly drilled by several operators at the rate of about 9 per hr. Now one woman tends three fixtures and produces about 22 burners an hour. Procedure is:

A burner (gray-iron casting) is centrally located in the fixture by two double-action air-clamps, controlled by a triple valve. Sliding clamp locates burner in drilling position by pushing at one end with a notched V-section, while a back clamp holds part down in the nest. Clamps operate under 90 psi. air pressure.

A master switch activates Microswitches that synchronize two No. 18 Kingsbury drilling units. The units are mounted on opposite sides of the fixture at 24° to the horizontal line of the burner. They take 1-in. drilling strokes, and each drills 43 holes, making a double row of holes approximately the length of the burner.

No. 36 drills are aligned with bushings attached to the Kingsbury units. Depending on the hardness of the castings, a drill will last from 10 to 50 castings before removal and resharpening on a drill grinder near the work station. Operator is encouraged to watch for blue or brown tinting of the drill as a signal for sharpening. Only 20 to 30 sec. are required for sharpening, while up to 5 min. are lost in breakage.

Two-way Drilling

Two drills enter the burner simultaneously from opposite sides and are withdrawn. Microswitches activate solenoids that control the cylinders on the Kingsbury units, regulating the 1-in. strokes. Special cams for this action are enclosed within the Kingsbury housings. Microswitches also synchronize air-cylinder action beneath the burner bed, operating a ratchet on the fixture to equalize the distance between ports, or holes, in the burner.

To balance the fixture while each port is being drilled, and to overcome the passage of the ratchet, a 9-lb. counterweight is attached to the bottom of the burner holder and hangs inside the fixture. When fixture comes to a halt after the 86 ports are drilled, operator opens a valve to release the back pressure on the air cylinder, and the weight returns the piston to the ratchet starting point for placement of another burner.

When the 86 ports are finished, operator replaces the drilled piece with a rough casting, and places the former in a radial-drill fixture for drilling the 10 end ports. After a Detroit quick-clamp has been closed manually on this piece, operation is entirely automatic.

This end port driller consists of a No. 15 Kingsbury unit mounted

horizontally in a fixture that enables burner to be radially positioned with the end facing the thrust of the No. 36 drill. The stroke is again 1 in. and return, and is regulated thus:

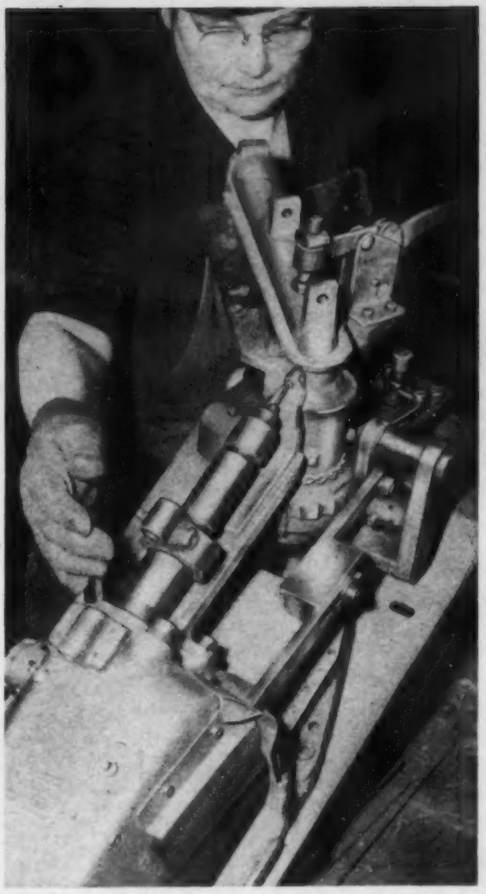
A special cam on the Kingsbury housing activates a trunnion upon which is a dog that engages a ratchet. The ratchet swings the bed of the burner through an arc, positioning it for each stroke of the drill automatically. When the last end port is drilled, a pawl on the ratchet operates a release mechanism to stop the drilling.

This mechanism is balanced with a 15-lb. counterweight to keep the burner from fluttering as it is pulled from position to position on the ratchet. It also helps position the fixture for drilling the first port on the next burner.

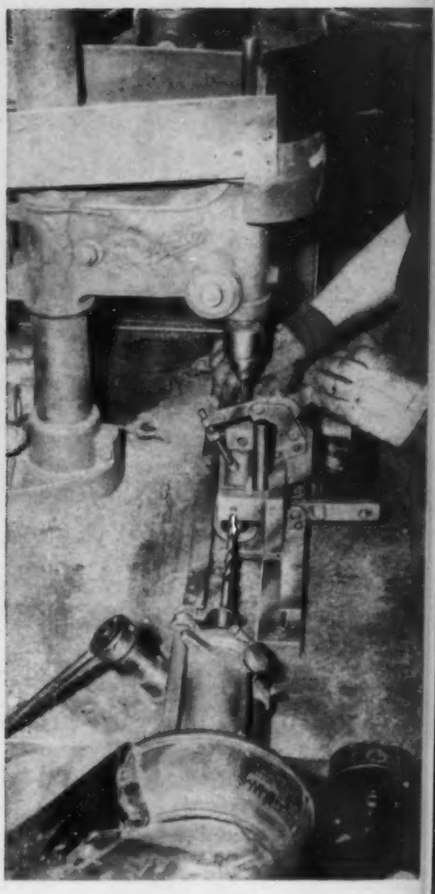
On the same table which holds the end port fixture is a sliding fixture, set up horizontally in line with a Buffalo No. 16 unit mounted on the side of the table. This drills two ⅜-in. holes for the burner hanger. Since these two holes are about 5 in. apart, a special drill 8 in. long is required.

The burner is positioned in the sliding fixture, held with a Detroit quick-clamp, and the drill is fed in. When the first hole is drilled, burner is slid along until the drill meets the second hole boss. Burner is then in position for the last operation which is done with a Buffalo No. 10 machine, vertical to drill the lighter tube holder.

All the fixtures are fabricated of 2x2 and 2x4 in. channel iron, and are of welded construction.



***Activated** by a special cam in the drill housing, and controlled by a ratchet, a trunnion on this fixture indexes part for drilling of radial end ports*

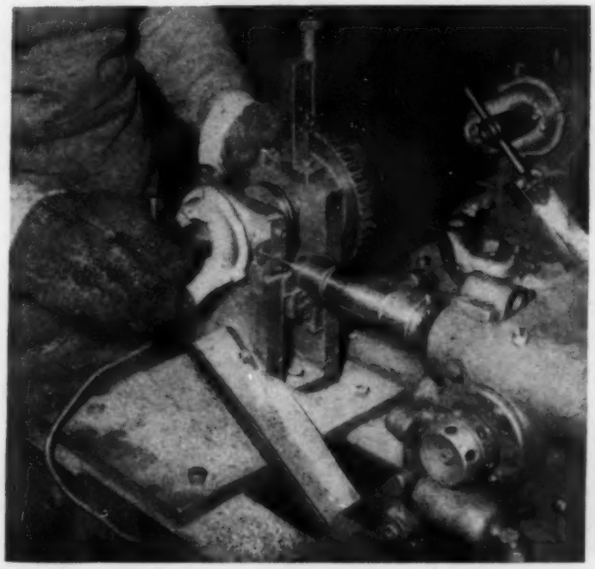


***Combination** horizontal and vertical drill setup for hanger holes and lighter tube holder*

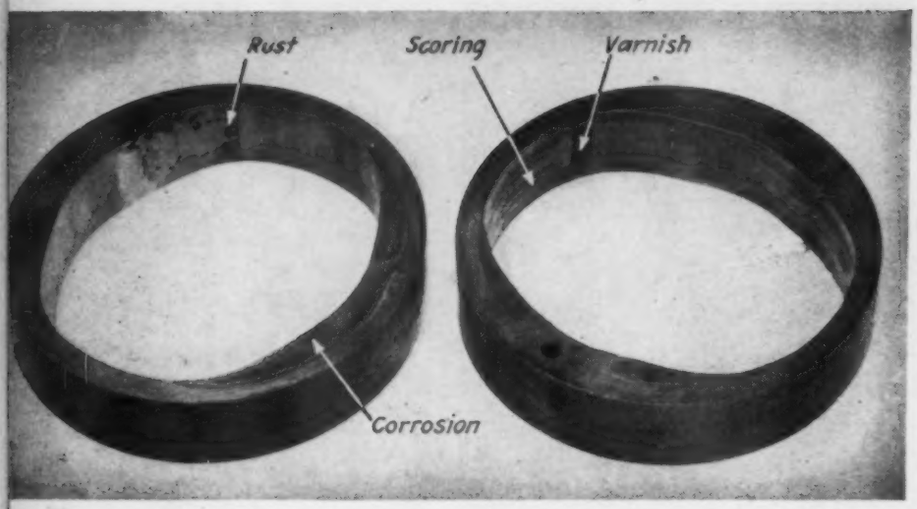
For drilling top burners, five No. 18 Kingsbury units are mounted horizontally on a steel table. These run at 4950 rpm. and take a 1½-in. stroke. Odin requires two different size of top burners, and has three of the machines drilling 58 ports each for the giant burner, and two drilling 44 ports each for the regular burner. The Kingsburys are pneumatically operated thus:

Operator, who tends all five units, places burner in machine and uses a speed-clamp to hold it in position. She then trips a bar that operates a compressed-air valve which in turn releases a clutch to start the reciprocating action of the Kingsbury unit. At the same time, a cam in the housing of the Kingsbury activates an arm with a pawl that moves a 7-in. ratchet wheel with 58 teeth.

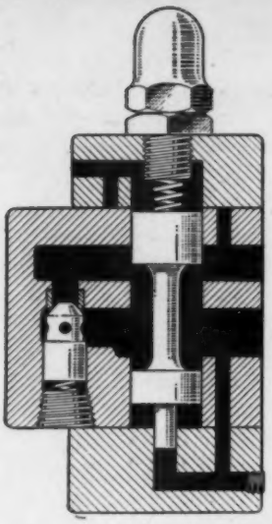
The ratchet causes the burner to be automatically moved into position for each of the 58 holes in a giant burner. A 6-in. ratchet is used for the 44-port burners. These fixtures also use 90-psi. air pressure. About 40 giant burners and 40 regular burners are finish-drilled by five fixtures in an hour.



***Closeup** of top burner drill fixture showing ratchet for controlling number of holes. Five of these units can be tended by a single operator as each is fully automatic*



Ring Failures of rotary-vane pumps occurred from presence of moisture in hydraulic oil lacking rust-preventive qualities. Left—A "first-stage" failure. Right—After further deterioration of the oil, varnish was deposited and scoring took place



Valves, like this sequence and check type, are closely fitted, highly finished mechanisms. Erratic operation results if the hydraulic oil does not provide constant lubrication, rust prevention and freedom from varnish, particularly in respect to the piston. Sludge deposits are detrimental to operation of the check valve

What to Look For in Hydraulic Oils...VII

NON-CORROSIVE QUALITIES

Equipment deteriorates rapidly whether in use or idle, if the hydraulic fluid lacks ability to prevent rust and corrosion

BY ANTHONY J. ZINO, Jr.
Lubrication Engineer

CONDITIONS within hydraulic circuits are favorable to formation of rust and, at times, corrosion. These two chemical reactions adversely affect the wear life of moving parts and hence the life expectancy of the hydraulic circuit. Protection against rust and corrosion must be provided either by any natural inhibitive properties of the petroleum oil or, more usually, by processing the oil with organic-chemical inhibitors.

The causes and effects of rust and corrosion are different. In addition, there is a chemical distinction between rust and corrosion, although rust is considered a phase of corrosion. In brief, rust is the product of oxidation of ferrous metals and is reflected in metal growth, whereas corrosion is the effect of acids on metals and produces metal loss.

Rust formations are various oxides of iron produced by chemical reaction of water and oxygen with iron. Two iron oxides are commonly found in hydraulic circuits: ferric oxide (Fe_2O_3) and black magnetic oxide (Fe_3O_4). Formation of these oxides within a hydraulic circuit is favored by condensate (from precipitation of atmospheric moisture in sumps) and by absorbed air in the oil.

Mineral-oil films, such as obtained from non-inhibited petroleum-base hydraulic oils, often do not adequately protect metal surfaces within a circuit against attack by moisture and absorbed air, because:

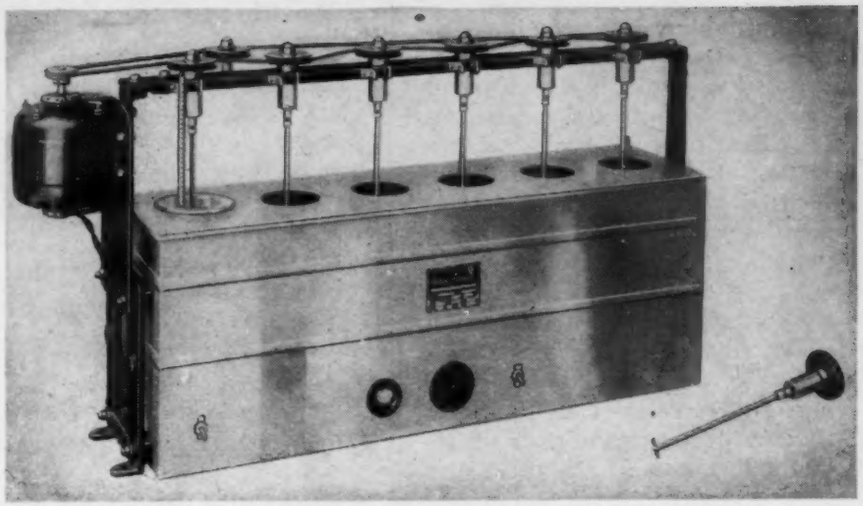
1. Metallic surfaces, in the presence of highly refined petroleum oils, are theoretically dry. Such oils are chemically inert and lack ability to wet metallic surfaces. The degree of dryness is a function of temperature. The higher the surface temperature, the drier the surface will be, because the oil's affinity for metal is lowered.

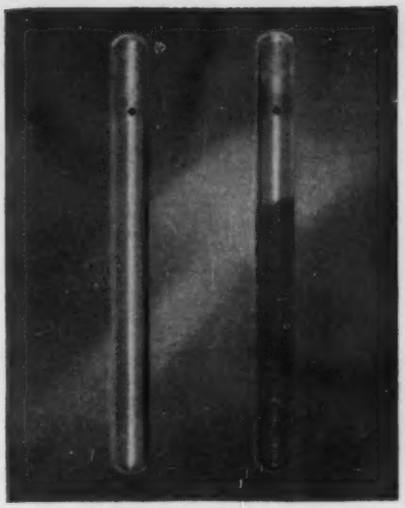
2. Metallic surfaces become activated in presence of these highly refined oils and particularly so with rise in temperature. As in the case of activated charcoal, the absorption power of the metallic surfaces increases sharply, and they then become capable of removing impurities such as air and moisture from the adjacent oil film.

3. Under these conditions nascent oxygen is formed and, in the presence of iron and water, it causes the oxidation reaction to proceed until visible rust is ultimately produced.

This type of chemical reaction can be minimized or avoided for long periods if the highly refined petroleum oil contains organic compounds known as rust inhibitors.

These may occur naturally to





Evaluation of hydraulic oils for rust-preventive qualities can be done in a turbine-oil testing bath, according to ASTM Test D665-46T. The left-hand test rod was unaffected by exposure to inhibited oil containing moisture. But the right-hand rod was badly rusted because the oil tested lacked suitable rust inhibitors

an extent in the oil, or develop in service by oxidation of certain hydrocarbons, or be processed into the oil during its manufacture.

The mechanism by which these rust inhibitors act to protect metallic surfaces against rusting is reasoned as follows: The compounds are hydrophilic (possess strong affinity for water). But their chemical affinity for metals is greater than it is for entrained moisture and absorbed air, and hence they are chemically absorbed from the oil stream by the activated metal surfaces and plate these surfaces with a molecular film. In other words, the film acts as a barrier to direct contact of water and air with the iron.

Evaluating Rust Prevention

There are at present two tests which can be extended to evaluate the rust-preventive qualities of hydraulic oils. The first test—A.S.T.M. Test Designation D665-46T—is designed for evaluating the rust-preventing characteristics of steam-turbine oils in the presence of water. In this test, steel rods are carefully prepared and suspended in a mixture of 10% water and 90% oil. The mixture is heated to 140 F. and agitated continuously for 48 hr. After this period, the rods are removed and examined. If rust is evident in any quantity the oil is considered unsatisfactory in rust-preventive qualities.

Although a higher percentage of water is used than advisable for testing hydraulic fluids under service conditions, the results of the test should be indicative of the rust-preventive qualities of a hydraulic fluid.

The second test—the humidity cabinet test—was orginally designed for evaluating the rust-preventive qualities of films produced by rust-preventive materials. This test is usually conducted at either 100 or 120 F. for periods ranging from 48 to 500 hr. in a cabinet which is maintained at 95 to 100% relative humidity. The test consists of dipping either highly polished or sandblasted steel panels, usually 2x4 in., in the oil to be tested for a period of 5 sec. to 1 min. then allowed to drain for 2 to 24 hr. Following this, the panels are transferred to the humidcity cabinet.

Although the humidity cabinet test is an excellent "Go" or "Not Go" screening test for rust-preventive coatings, such as are used on instruments and equipment, it is far too severe for practical evaluation of the rust-preventive qualities of hydraulic fluid films. Duplication of results is difficult. For consistent results, great care must be exercised in preparing the panels. It is safe to say that most oils which will pass the 200-hr. humidity cabinet test will easily pass the A.S.T.M. Test, while the reverse is not true.

DAMAGE CAUSED BY RUST

Destroys Surface Finish:

Rusted metal surfaces increase friction losses and wear. Rust particles in the oil stream are likely to score highly finished moving surfaces.

Reduces Clearances:

Surface growth caused by rust formation increases wear, leads to scoring and seizure.

Causes Erratic Operation:

Rust particles in the oil stream clog small orifices in valves and pumps, thereby changing the designed characteristics of the circuit.

DAMAGE BY CORROSION

Destroys Surface Finish:

Etching and pitting of machined surfaces accelerate wear and may bring about fatigue failures of highly stressed parts.

Corrosion's Importance

Although corrosion in itself is not a particularly important problem in hydraulics today, there are times when it does become critical. Corrosion is the chemical effect of organic acids on metallic surfaces and is normally reflected in metal removal. Its rate of reaction is affected by the presence of organic peroxides and other types of catalysts.

The corrosive ability of a pe-

troleum oil is a directly influenced by the oil's resistance to oxidation, which in turn is governed by the two important factors discussed in Installment V—"Oxidation Stability:"

1. *Composition Of The Fluid:* Crudes from which it is made; its method of refining; and its subsequent treatment with additives.
2. *Conditions Under Which the Fluid Must Function:* Temperatures; pressures: extrinsic contaminants; and reactive metals.

It is therefore possible to improve the corrosion-preventive qualities of hydraulic fluid by increasing its resistance to oxidation. The use of highly refined stocks and their subsequent processing with oxidation inhibitors will definitely minimize, if not eliminate, the occurrence of any problems attributed to corrosion. Avoidance of operating conditions that adversely affect the oxidation stability of the oil will also be helpful in improving the oil's corrosion-preventive qualities.

At present there are no standard A.S.T.M. Tests specifically designed for evaluating the potential corrosivity of hydraulic fluids. However, the application of other lubricant corrosion tests can be of some value in this work. As a matter of fact, these tests might also be indicative of the relative importance of corrosion inhibitors in hydraulic oils and their true effectiveness.

This installment concludes Mr. Zino's series on hydraulic oils.

THE author wishes to express appreciation to the following individuals and companies for assistance in preparing the series on hydraulic oils:

Prof. D. D. Fuller, Columbia University
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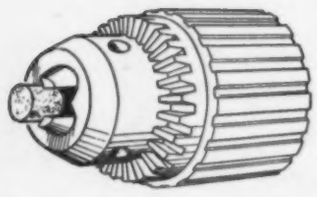
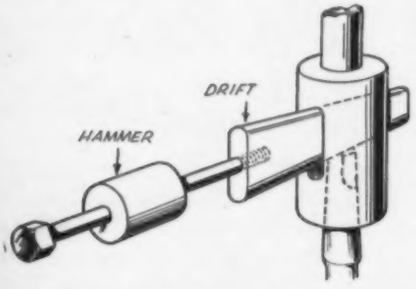
Hydraulic Press Mfg. Co.
LaPointe Machine Co.
Northern Pump Co.
Oilgear Co.
Racine Tool & Machine Co.
George D. Roper Corp.
Sundstrand Machine Tool Co.
Superdraulic Corp.
Vickers, Inc.
Waterbury Tool Co.

Short Cuts FOR THE SMALL SHOP

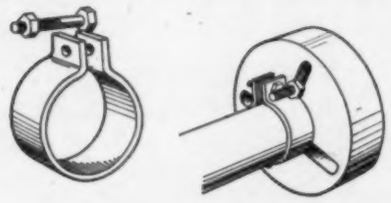
BY A. H. WAYCHOFF



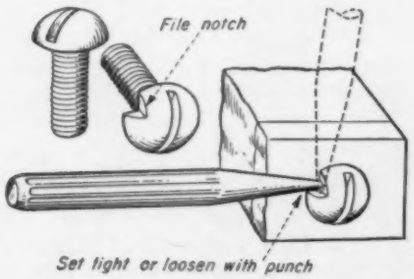
A CORK pushed into the jaws of a drill chuck, while it is not in use, will keep dust and dirt out and prevent damage from accidental bumps.



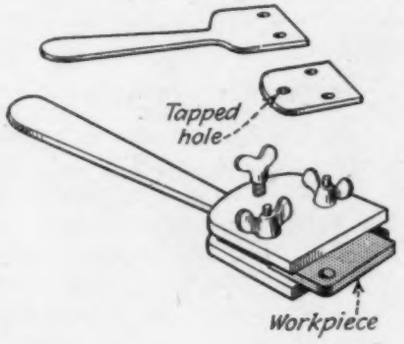
A DRIFT with a built-in "hammer" leaves one hand free to catch the drill and avoids looking for the conventional hammer. Drill and tap the large end of the drift to receive a capscrew. Make a hammer from cold-rolled shafting and drill for a sliding fit on the screw. Assemble the components. To use, slide the hammer smartly against the back end of the drift to loosen the tool.



IF LATHE DOGS are too small for driving large parts between centers, make a strap-iron clamp similar to a hose clamp and set a driving stud in the faceplate.

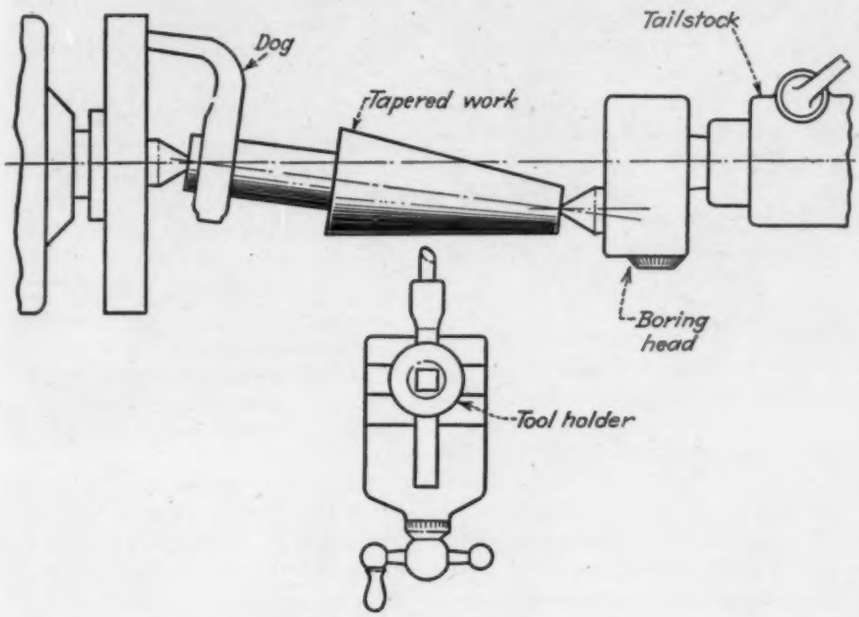


TO AVOID SPLITTING the head of heavy machine screws, as can happen when tightening with a heavy screwdriver and wrench, file a notch (shown exaggerated) in the screw head. When the screw is fairly tight, remove the screwdriver, and use a punch against the side of the notch to set the screw really tight.



INJURIES WILL be avoided, and faster work done, if parts are presented to a grinding or polishing wheel with a suitable holder. One type consists of a paddle-shaped piece of plate steel (with the paddle portion about 3 in. wide) and another piece of same size but without the handle. These two parts are drilled and clamped to the workpiece with a thumb screw and two clamp bolts.

Practical Ideas



Offset Boring Head Saves Time When Taper Turning with Lathe

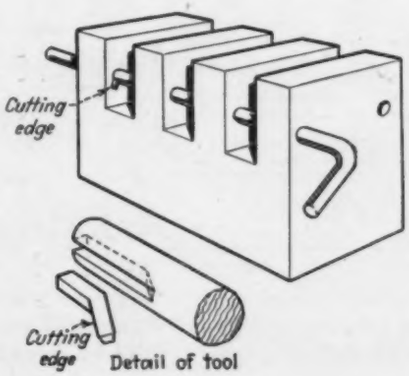
For the occasional taper-turning job, a lathe without a taper attachment must have its tailstock set off center. To find the correct amount of offset, several trial cuts are usually necessary. When the job is finished, the tailstock must be set back accurately to center again.

This last time-taking correction can be eliminated with the following system: Use a standard milling-machine micrometer-adjustable boring head having a Morse taper shank to fit the tailstock. Make a hardened 60° center plug to fit into the socket where the boring bar is normally clamped. Instead of moving the tailstock off center as before, move the small center plug in the boring head. The effect is the same, the adjustment is simple and positive, the off-center position is easier to find, and when the job is finished no resetting is necessary. The boring head is simply removed.

If successive pieces are to be turned, the adjustment of the boring head can be left as required and inserted when needed. The boring head need not be altered in any way, but can remain ready for use on the milling machine. *J. W. Rundt, Canton, Ohio.*

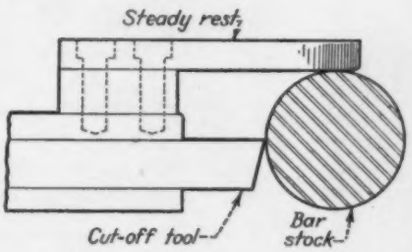
Tool Burrs Small Hidden Holes

Burring small holes in inaccessible or hidden positions, in such work as electrical parts production, is often impossible without development of special tools for specific jobs. The illustrated hole edges were burred in an unusual way.



A steel rod that slip fitted into the drilled holes was bent at one end to provide a handle, and was slotted partly through at the other end. The slot was just wide enough to hold a small tool made of spring steel. When burring, the rod was inserted in the hole until the small slot was exposed through a slot in the part. The tool was then inserted in the rod with long-nosed pliers and the rod was pushed forward and rotated. This way a radius or chamfer was formed on the edge of the hole. By pulling out the tool, resetting the rod to another opening, and replacing the tool, all holes were burred on one side.

To get the opposite edges of the holes the rod was entered from the other end of the part. The result was that all edges were burred uniformly and quickly. *Robert J. Chrosniak, Buffalo, N. Y.*



Steadyrest Controls Cut-Off On Lathe with Loose Bearings

When using a cut-off tool in an old engine lathe with loose bearings, the tool tended to hog into the work and break off. For a production job requiring the cut-off of 3-in. bar stock, a steadyrest was rigged on the toolholder. With the rest holding stock in position, the crossfeed was used to make the cut. If used as a rear toolpost, the rest would be under the work. *Nels Malmgren, Chicago, Ill.*

Tool Fixture Produces Spherical Holes Using Locomotive Principle

A spherical hole would seem to be a useless shape to make because of the difficulty of pushing a spherical peg into the hole once it was made. The arrangement, however, produces an efficient ball and socket joint, and a partial sphere was made using an unusual lathe tool.

The component shown in Fig. 2 is the female portion of the joint. It will be noticed that the hole is not a complete sphere since the lug is narrower than the sphere diameter. In addition, a rectangular hole is slotted through the lug with its length the size of the sphere diameter and its width the size of the diameter of the hole where it breaks through the sides of the lug.

The mating ball-ended shaft has a pair of flats machined diametrically opposite each other on its spherical surface. The distance between these flats is slightly less than the width of the slot cut in the lug. The flattened ball was inserted in the spherical hole and given a quarter turn. The result was a compact ball-and-socket joint of limited range.

The tool evolved to produce the hole is shown in Fig. 1 with its top cover plate removed. Connecting rod *B* is extended and contains a hole for boring bar *F*, which carries a high-speed steel tool.

When pressure is applied at *G*, the disks rotate, and any point on rod *B* will describe a circle whose radius is equal to the length *H*. The lower rod *C* is present merely to eliminate dead center losses.

It can be seen from Fig. 1 that the disks have no center bearings but are constrained in their movements by the fit of their outside diameters in plate *I*. Their positions in a vertical plane are maintained by their resting on shoulders *J* machined on their diameters.

The complete tool was built up from steel and the holes were produced on a jig boring machine to insure fine running tolerances. Only the link pins were hardened, since the stresses and velocities in the mechanism are low. Very fine clearances were maintained between the upper and lower faces of the two rods. Rod *B* was finished on a surface grinder along with

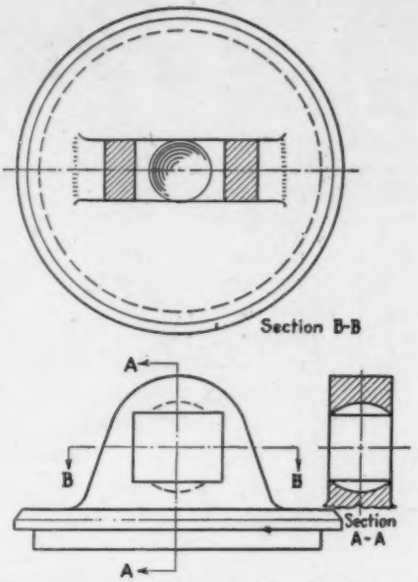


Fig 2. Ball joint is assembled by inserting male part into female, shown above, and turning it a quarter turn

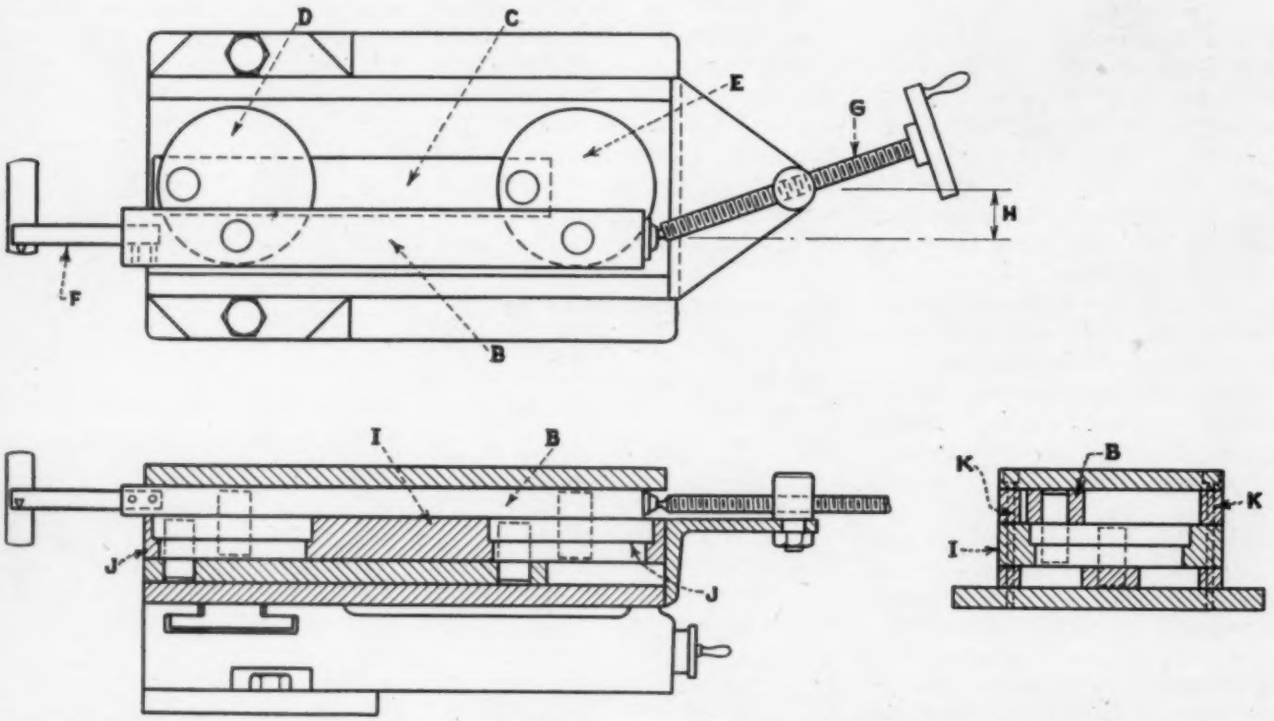


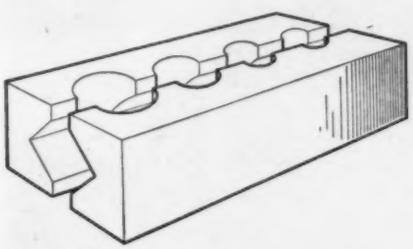
Fig. 1. Fixture for producing a spherical hole is built up from steel. It works on the principle of a locomotive, with rods *B* and *C* corresponding to the coupling rods and two disks *D* and *E* corresponding to the wheels. Connecting rod *B* is extended and carries the boring bar *F*. The mechanism should be moved in one direction only when cut is made

spacing strips *K*. Upon assembly about 0.001 in. of packing was interposed between the tops of strips *K* and the cover plate, thus providing clearance. Similar technique was used throughout the tool.

The tool was designed to suit the lathe on which it was used and care was taken so that the tool point and the lathe spindle axis were in line horizontally. This was important to provide little or no error in the spherical shape.

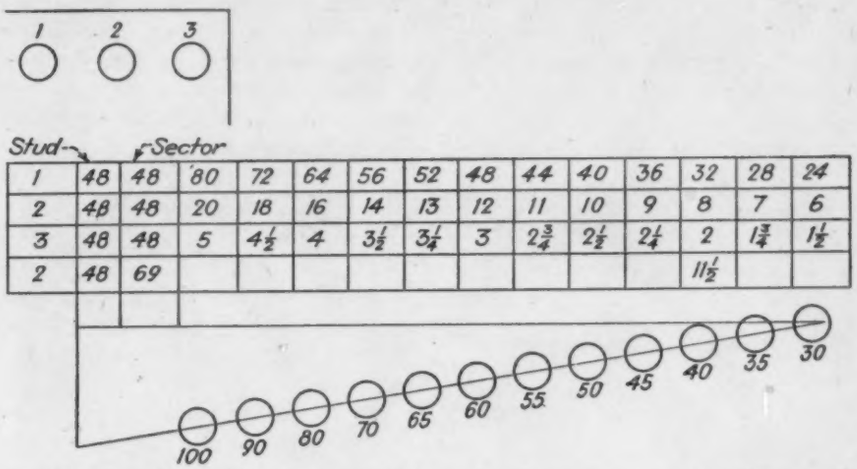
An important precaution to be observed when using a fixture of this type is that the cutting tool point must be accurate. A sharp point will be most accurate, but produces a poor finish. In this case a round point was used. The size of the round is not important, but the round must be a true arc of a circle.

In order to make a sphere of smaller size it is only necessary to alter the radial position of the link pins by setting them in new positions in the two disks. *Clifford T. Bower, Jacksonville Beach, Fla.*



V-Blocks Have Unlimited Uses

Special-shaped V-blocks can be made to suit any particular job, but the blocks illustrated have been in use for some time and have been found to be adequate for the majority of the clamping jobs in the shop. The V itself is used to hold many sizes of shafts for milling and shaping jobs. Size of the blocks should be selected to match the dimensions of the vise in use. As many graduated holes as desired can be included and they will clamp an unlimited number of small parts. The original blocks are made of bronze, which minimizes the chances of marring the parts being machined. *L. H. Hardcastle, Port Arthur, Tex.*



Stud	Sector													
1	48	48	80	72	64	56	52	48	44	40	36	32	28	24
2	48	48	20	18	16	14	13	12	11	10	9	8	7	6
3	48	48	5	4½	4	3½	3¼	3	2¾	2½	2¼	2	1¾	1½
2	48	69										11½		

Standard gearbox plate, listing threads per inch that can cut by shifting gear change levers without changing sector gear in main gear train

Quick Method of Calculating Gear Changes Not Listed on Gearbox Plate

On a lathe in which the gears were arranged as shown in the accompanying illustrations, it was frequently necessary to cut threads of a pitch not listed on the gearbox plate, such as 30 per in., 27 per in., and 0.25 mm. It was known that the gears opposite each station stop hole had teeth corresponding to the number marked under each hole, i.e., from 30 to 100. By observation it was noted that the numbers on the first line of the plate were 4 times as large as those on the second line, and that those on the second line were 4 times as large as those on the third line. It was also noted that a 69 tooth gear is required for cutting 11½ threads per in., instead of 48, required for all the others.

This gives a key to the method and produces an equation:

$$69 : 11\tfrac{1}{2} = x : 40$$

Solving for x gives 240, which is used as a constant in all calculations to determine the number of teeth on the sector.

For example; to cut 27 threads per in., divide 27 by 4 (since line 1 is 4 times line 2), and obtain 6¾. The proportion then becomes:

$$x : 6\tfrac{3}{4} = 240 : 30$$

or x = 54, the number of teeth required on the sector gear.

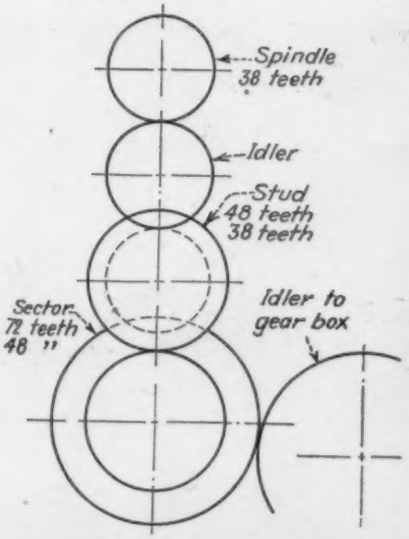
The figure 30 is selected from the numbers marked under each stop hole, and is selected because it produces a whole number of teeth on the required gear. If 40 were selected, 40½ teeth would be the answer, which is impossible.

To cut a 0.25 mm. thread, convert to inches, giving 101.6 threads per in. Dividing by 4 gives 25.4. Solving for x in the proportion

$$x : 25.4 = 240 : 100$$

gives a figure of 60.96. A 61 tooth gear produced good work.

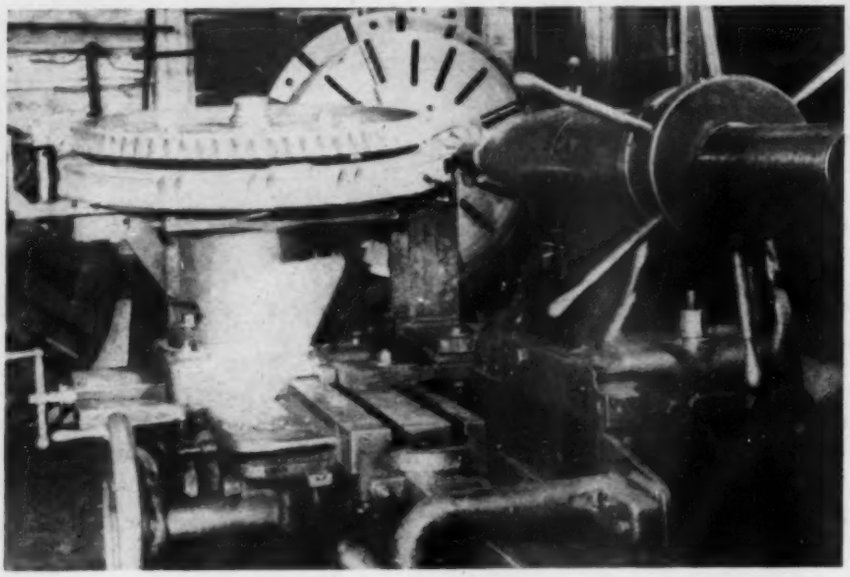
By stating the proportion in the



Arrangement of change gears, showing numbers of teeth on stud and sector gears used in conjunction with standard gear box for cutting threads

manner shown above it is possible to divide the product of the means by the extreme representing the number of teeth in each available gear until a satisfactory result is obtained—if one is possible.

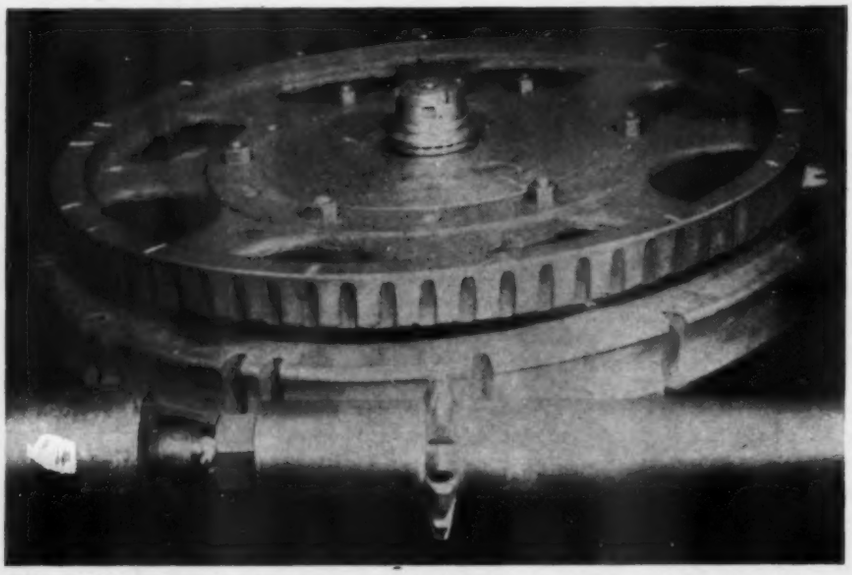
The station stop holes are used in the regular manner, according to the threads required. This method gives a substantial increase in range with very little increase in cost. *Wilton F. Hoag, Batavia, Ill.*



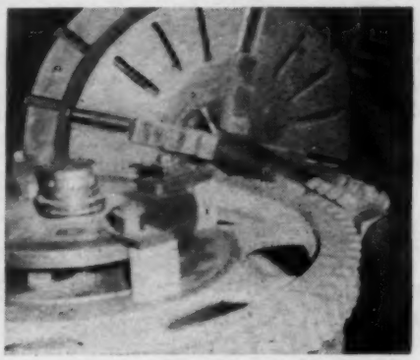
Worn Gears Gashed and Hobbed On Large Gap-Type Engine Lathe

An interesting method of worm wheel milling without centers was described last year by Charles W. Metter. We used a variation of this method to gash and hob worm gears, using a lathe instead of a milling machine. The blanks were about 40-in. dia. and we had no milling machines large enough for the job.

A gap-type engine lathe with a 60-in. faceplate was available. The toolpost compound was removed and a table was built up to carry the work. The crossfeed, compound base, and table had the same function as a milling machine table, with the cutters mounted on an arbor between centers in the lathe.



Index ring and blanks to be cut were bolted together on the roller-bearing turntable. Gashing cutter is mounted on the arbor



Final hobbing is performed with work in horizontal plane and worm hob mounted on the arbor

The cast-iron worm-gear blanks had a bore of 17 in. Teeth were turned off on a discarded worm gear, leaving enough tooth section to serve as an index. This index and a blank were bolted together on a roller-bearing turntable.

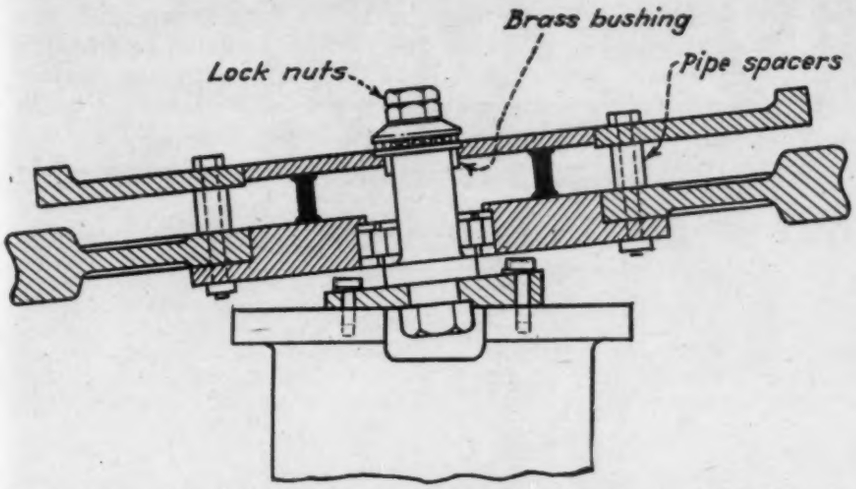
This turntable was fabricated by welding. The roller bearing was of the aligning type. The thrust bearing registered into the top index plate served to keep the roller bearing in alignment.

A gib key of 1¾ in. key steel was shaped to the 5½° helix angle of the worm gears and fitted into the support structure. It was placed just ahead of the gashing cutter, straddling the crossfeed slide.

A piece of 2-in. armor plate was machined in a shaper to the helix angle and bored to form a light press fit on the stub shaft. The thickness of the solid collar behind the roller bearing was the final factor in positioning the height of the turntable unit. The rim of the blank was thus positioned so that it was centered on the gashing cutter.

The table was fed into the gashing cutter using the automatic crossfeed. Depth of cut was marked on the compound base and crossfeed screw so that gashes were made to a uniform depth.

The gashing cutter had a 6½-in. dia. with 29° included angle.



Construction of the turntable; tapered base plate used for gashing shown in this view is replaced with flat plate for hobbing

Teeth had a 5° positive radial rake angle. Climb milling was used and there were always three teeth in contact with the work so that there was no chatter. It was found advisable to block index to avoid distortion from heat.

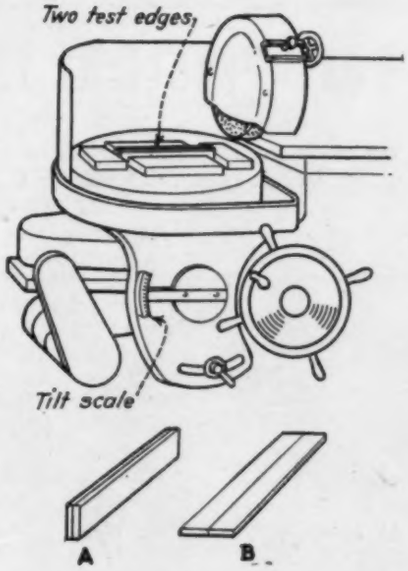
Enough stock was left to finish the tooth contour with a hob. A parallel base plate was substituted for the tapered base, and a parallel gib key for the tapered key to place the worm in a horizontal plane centered opposite the center of the arbor. The rotation of the hob rotated the worm wheel to complete the tooth generation. *Neil MacLeod, Machine Shop Foreman, Britannia Mining and Smelting Co., Ltd., Britannia Beach, B. C.*

Grinder Rotary Table Checked By Grinding of Two Thin Bars

When a surface is ground on a surface grinder of the horizontal or vertical type having a magnetic rotary table, there is always a tendency for the ground surface to become slightly concave or convex. It is only when the tilting frame, which carries the rotary table, is adjusted very accurately that a true plane surface is ground.

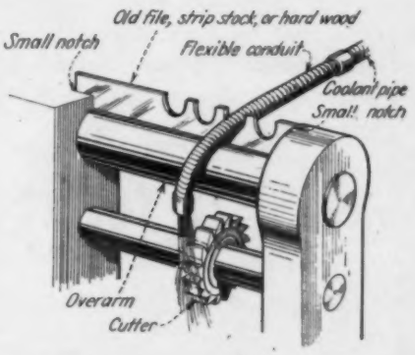
An inherently accurate and positive test to insure such a setting is to mount two thin, flat bars side-by-side on the magnetic table and grind their edges, taking a fine cut. The bars are then removed and held up against the light, with their ground edges face-to-face. Any error in straightness will show up as a light leak between the two surfaces, with light at the edges showing convexity, and light in the center, concavity.

An alternate method is to use a coloring material, such as Prussian blue, and rub the surfaces together. In either case the tilt of the table is modified slightly by adjusting the handwheel under the table, and the bars are reground as a check. After several trials the bars will match along their edges so that almost all light is excluded. This indicates that both bars have been ground to straightedge and that the machine is accurately set to grind a true plane.



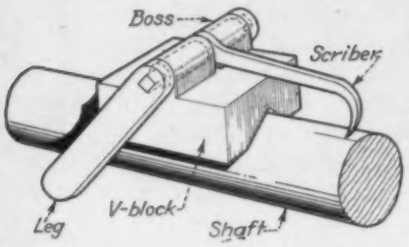
Identical conditions of surface convexity are also encountered when surfaces are ground on a universal grinding machine, by holding the work in the headstock chuck and fixing the headstock at 90 degrees so as to have its axis at right angles to the direction of table traverse. Unless the taper setting of the table is on dead center a true plane will not be ground. With the above method the required setting can be found very precisely. This test is based on the fundamental principle that if two edges fit each other side-by-side and also face-to-face, they are necessarily straight.

This principle has double utility in that straight edges can be originated at the same time the machine is being checked. After grinding, the bars should be lapped. *S. Framurz, Bombay, India.*



Coolant Pipe Guide

A flat strip of steel, like an old hacksaw blade, with several large half-round notches ground in one edge makes a handy rack to adjust flexible coolant conduits on a milling machine. As one arbor is in fairly continuous use, especially in production work, small notches can be cut in the overarm bracket and in the machine column to receive the strip and hold it squarely atop the overarm. One or more conduits can then be placed neatly in any groove where they will then stay put regardless of vibration or accidental jarring. *Donald Campbell, Cincinnati, Ohio.*

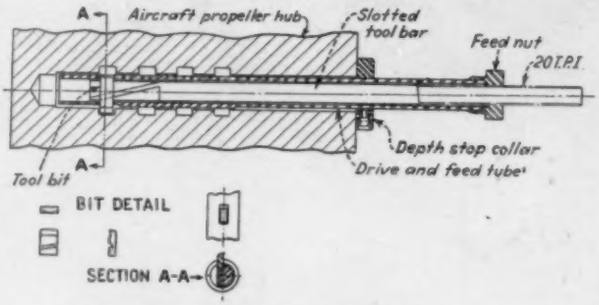


Shaft Positioned for Drilling

Often during the layout of a milling or drilling job, or a combination of both, it is necessary to position a line scribed longitudinally along a shaft so it is at the exact top of the shaft. The drawing shows a simple locating device that will determine the position exactly.

The boss on top of the V-block is drilled to take a shaft, and a slot is made at the center of the V. The shaft is squared at both ends to fit into the two legs, which are rivited lightly to the shaft. When the parts are assembled, the scriber turns on the shaft and the shaft is turned by the weight of the legs. These legs must be alike and parallel for correct operation of the device, and the scriber must be parallel to the shaft.

To locate the scribed line on the shaft, the shaft is laid in V-blocks or on a surface plate. The device is positioned on top of the shaft, and the legs drop to the plate to hold the V straight and upright. The shaft is then rotated so that the line coincides with the scriber point, and the work is located. *H. Moore, Leeds, England.*



Grooves Cut in Blind Bore With a Special Lathe Tool

Faced with the problem of cutting four grooves in a ⅝-in. bore in a Dural housing, we solved the problem with the tool illustrated. The bore was blind at one end and the grooves had to be accurate as to diameter, width, and spacing.

The work was held in a lathe chuck and the tool mounted in a clamp-type boring toolholder. The drive and feed tube which carries the toolbit has a stop collar which can be accurately adjusted to place the tool at the proper depth in the bore. An angular groove in the toolbit fits over a tongue on the toolbar.

The toolbit is advanced into the work and withdrawn by movement of the toolbar. This bar is threaded on the outer end to fit the feed nut. The depth of cut can thus be adjusted by turning the adjustment nut. *Allen MacNeal, Curtiss-Wright Corp., Propeller Div., Caldwell, N. J.*

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NEWS OF METALWORKING

Controls on Shipments to Europe To Hit Machinery, Machine Tools

WASHINGTON—The machinery and machine tool industry can expect shortly the greatest reinstatement of controls since the end of the war. It is coming in the field of foreign trade and will be carried out by the Commerce Department's Office of International Trade.

The trend toward more stringent control of exports, which really got going shortly after the turn of the year, has stirred up a hornet's nest of opposition among foreign traders throughout the country. But, all signs indicate that the opposition will be smothered by the hard necessity for adjusting U.S. exports to the realities of European recovery.

At the beginning of this year about 25% of the value of all American exports was under some sort of governmental restriction, chiefly through Commerce's power to establish export controls over goods in short supply. Begining March 1, at least half of all shipments abroad will come under government scrutiny—and from here on out there will not be much worry about whether there is short supply at home or not. The March 1 date was announced as the start for screening of virtually all commercial shipments to Europe, including the Soviet.

Extension Expected

Privately, high government officials in Washington admit that the added restrictions slated for Europe will eventually be extended to Latin America, and, if necessary, to other parts of the world. As they see it, the general license, except for shipments up to about $100 valuation, is about to disappear.

Basically, the March 1 procedure means that Commerce will decide what and how much U.S. goods go where in Europe.

The OIT already has this power with respect to a long list of goods, including railway cars, steel mill products, grains, fats and oils, tinplate, fuel, fertilizer, electrical machinery, non-ferrous metal products and a selected group of chemicals, building materials and scientific instruments. These are among the commodities in short world supply.

Commerce's control over these goods extends not only to Europe but to all other parts of the world as well. Now the government is going to control all goods going to Europe, whether or not they are hard to get.

Under the new control set-up, two tests will prevail for eligibility of exports. First, what contribution will the shipment make to European recovery? Second, what effect will it have at home?

Just how OIT is to go about answering these questions is not yet clear. It is going to be pretty much a matter of "learning by doing," judging each problem as it arises.

This screening process is going to be tough on OIT—but it will be a lot tougher on exporters, who are still groggy over the new price criterion that went into effect last month for most goods under export control.

Example—suppose an application to export toys to France comes through. Toys are not scarce, but the application would probably be denied as a waste of hard currency by the dollar-short French.

Ability to pay, however, will not be the sole test. Thus if an application to export trucks to dollar-wealthy Switzerland is presented, it might not make the grade because shipment is considered an unnecessary drain on the U.S. supply of trucks.

End use of a given item will be a major factor in the new procedure, just as it is now. Strangely enough, this affects machinery manufacturers as much as anyone else. If an exporter tries to ship compressors to Belgium for use in air-conditioning a restaurant, chances are he would not get a license. But, if he shipped compressors for air-conditioning a factory so as to step up production, this application might be granted.

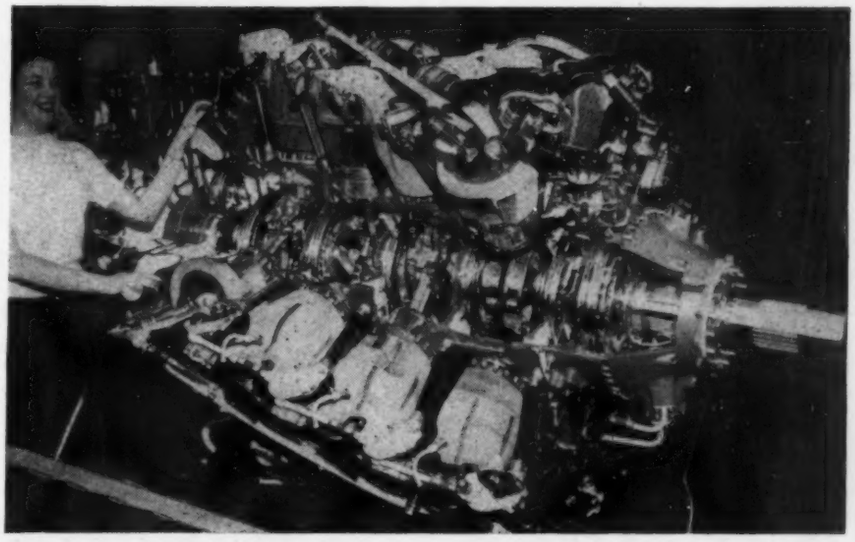
Little imagination is needed to see that the government may soon move to clamp down on exports to other parts of the world, notably Latin America, just as it is going to clamp down on Europe. The reason for this would be that a country like Argentina could turn a nice dollar by purchasing here and trans-shipping to dollar-wealthy countries in Europe.

Nor is it hard to see the check for foreign policy purposes the State Department gains as a result of this new control system. Exports of heavy machinery to Russia, or machine tools to Spain, could be checked or halted at a moment's notice.

Areas Affected

WASHINGTON — Commerce Department's new export controls will, in effect, wipe out the existing general license for shipment as to continental Europe, plus the following areas:

British Isles, Tangier, Iceland, Turkey, USSR, including Asiatic possessions; Portugal, including Azores and Madeira; Spain, including colonial possessions, and Mediterranean islands.



Rated In Excess of 3,650 hp., this cut-away Pratt & Whitney aircraft engine is kept turning over by a small electric motor for instruction purposes at the Burbank plant of Pacific Airmotive Corp.

ASTE Exposition March 15-19 Seen Group's Greatest

CLEVELAND — Exhibitors for the Sixth Industrial Exposition of the American Society of Tool Engineers are gradually increasing to a proportion which assures the society of the largest show in its history.

The exposition will be held March 15-19, in the Public Auditorium concurrently with the sixteenth annual convention. The show will include tools, machinery and processes. Attendance will be restricted to representatives of industry invited by exhibitors and the society.

Scheduled plant tours will be sponsored for the members of the society throughout the Cleveland area.

Technical seminars have been limited to three sessions for several reasons, according to Harry E. Conrad, executive secretary of the ASTE.

"First," he said, "a large number of technical sessions would detract from the exposition and conflict with other important activities. Most of the visitors will come to Cleveland primarily to see the show; the improvement in tools, machines, processes and methods. We, therefore, decided to have three seminars covering the areas most urgent for increased production. All of the technical sessions will be held in the evening and will in no way interfere with the exposition."

All sessions will begin at 8 p.m. in the ballroom of the Hotel Cleveland and will include:

Monday evening, March 15 — "Work Handling Simplification," Allan H. Morgensen, industrial consultant.

Tuesday—"Dies—Control of Deep Draws and Irregular Shapes," N. E. Rothenthaler, superintendent of production and planning, steel operations, Ford Motor Co.

Wednesday—"The Tool Engineers Quiz," a program in which 25 questions from those sent in by the society's members to be answered by a panel of experts under the chairmanship of Robert W. Ford, Ex-Cell-O Corp.

James D. Mooney, president and chairman of the board of Willys-Overland Motors, will speak at the annual banquet Thursday evening, March 18, in the ballroom of the Hotel Carter, Cleveland.

145th Birthday Marked

PITTSBURGH — Mackintosh-Hemphill Co. is observing its 145th birthday this year. Seven employees of the steel roll manufacturing plant have from 41 to 52 years continuous employment.

Founders of the American Metallizing Contractors Association, which was recently chartered in Illinois to promote the industry, are pictured above. Standing (l. to r.): Robert G. Ballou, vice president, Metallizing, Inc., Chicago; Knowles B. Smith, vice president and general manager, Dix Engineering Co., Inc., Detroit; J. E. Looney, president, Alloy Welding & Manufacturing Co., Inc., Tulsa; J. L. Henderson, director, The Thornton Co., Cleveland; Thomas H. Lufkin (chairman of the AMCA board), manager, Metallizing Dept., Tranter Manufacturing Co., Pittsburgh; Earl B. Ryder, owner, Spraymetal Laboratories, Minneapolis; Clyde H. Norris, John Nooter Boiler Works Co., St. Louis. Seated (l. to r.): Paul H. Magnus, vice president, Tranter Manufacturing Co., Pittsburgh; H. W. Moore, (AMCA vice president) Alloy Welding & Manufacturing Co., Inc., Tulsa; William H. Fatka (president of AMCA) president, Metallizing, Inc., Chicago; Walter B. Meyer (AMCA) secretary-treasurer), manager, Metallizing Division, John Nooter Boiler Works, St. Louis; and Peter G. Dennison, president, Metal Spraying Corp., Milwaukee

ASME Will Meet In New Orleans

NEW ORLEANS—The American Society of Mechanical Engineers will meet for the Spring session March 1-4, at the St. Charles Hotel here.

Nuclear energy will be the theme of a luncheon program opening the meeting Monday noon, March 1. The banquet will be held Wednesday evening.

Eight technical sessions are scheduled with 25 speakers from important industries presenting papers on gas turbines, metals engineering, power, materials handling, heat transfer, fuels, processing and management. Plant tours are planned.

Resistance Welder Unit Names T. S. Long as Head

T. S. Long, vice president and general manager of the Taylor-Winfield Corp., Warren, Ohio, was elected president of the Resistance Welder Manufacturers Association at the annual meeting Jan. 16.

B. L. Wise, chairman of the association's technical committee for the past year, was named vice president.

AMA Session Feb. 16

CHICAGO—Two thousand executives from all major industries are expected to attend a meeting of the American Management Association Feb. 16-18 at the Palmer House Hotel to consider Labor - Management relations during 1948. Both labor and government representatives will participate.

Third Instrument Show, Meeting Opens Sept. 13

PHILADELPHIA — The Third Instrument Conference and Exhibit will be staged at the Convention Hall Sept. 13-17 by the Instrument Society of America.

Other cooperating groups are: American Institute of Physics, Industrial Instruments and Regulators Committee of the American Society of Mechanical Engineers and the Instruments and Measurements Committee of the American Institute of Electrical Engineers.

Richard Rimbach is the exhibit manager and E. Grace is chairman of the committee for all arrangements.

Detroit

FLOW OF EQUIPMENT REPLACEMENT BUSINESS STEADY . . . SPECIAL TOOL DEMAND HOLDS STRONG . . . WEATHER HITS AUTO PRODUCTION

Although backlogs may be dropping in many machine tool plants, manufacturers in this area are pleased with the continued flow of equipment replacement business coming out of the automotive purchasing departments.

Replacement programs provide more efficient business for machinery makers. Operations are at steady rates and work can be figured more painstakingly, and is less liable to error than on new machines where there is less of an experience backlog to guide estimates.

One result of the absence of typical industrywide programs in the auto community has been a more competitive situation on the available jobs. Some tooling companies, for instance, are trying to plug up idle blocks of time by bidding on special machinery orders. In occasional instances they are successfully invading the special field.

Cutting Tool Makers Pleased

Cutting tool makers, particularly in the special tool classification, are quietly pleased with the fact that so many of their incoming orders provide for near-term shipment. They interpret this to mean that inventories in user hands are rather slim—healthily slim.

Tool and die shops, meanwhile, are working along on a steady plateau of activity. Schedules are staying uniformly around 45-46 hours a week, and bid fair to so continue.

Reports from a large cross-section of Detroit shops in this category indicate that delivery promises are just about the same as they were six months ago. Jigs and fixtures can be obtained in about a month, gages between two and three weeks, sheet metal dies between four and five weeks, and forging dies between six and seven weeks. Naturally these time-spans vary with individual shops.

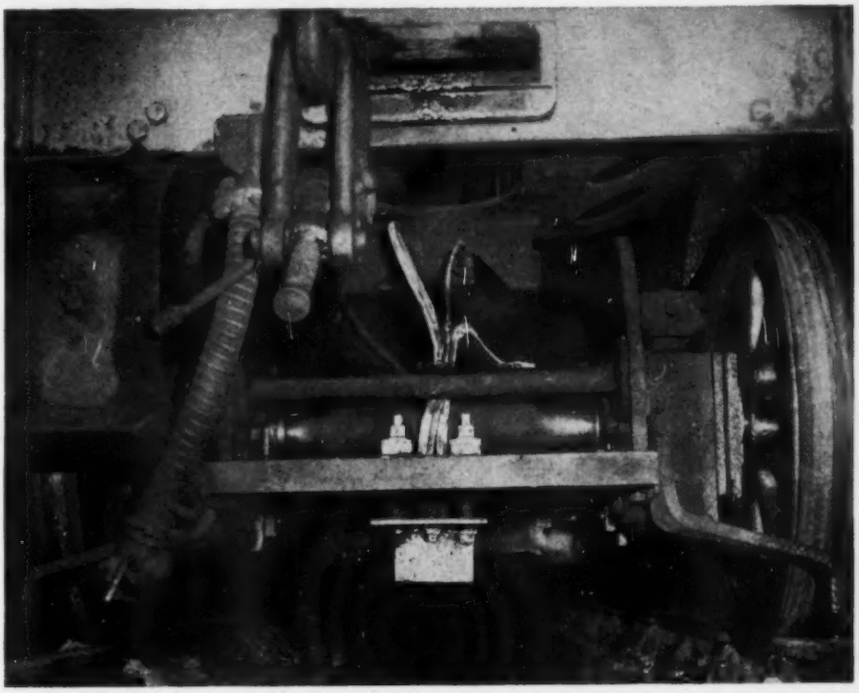
Even though purchasing agents report a general upward tendency on prices in all categories, some feeling exists that this will not continue indefinitely as indicated by reports of the Detroit Purchasing Agents Assn., showing modest centralizing of forward buying in the 3-month zone. Hand-to-mouth buying has advanced slightly, but purchasing for delivery within a month has reduced of late, as has buying two months ahead. Three-month commitments have gained favor, part of their increase being at the expense of 6- and 9-month buying.

Inventories Reduced

In the face of the rather cautious buying policy, inventories are showing some reduction at Detroit plants, although not substantial. Doubtless some of this inventory cutback has been due to the strenuous pace of automobile production during the year-end and since then, up to late January.

Output of cars and trucks has yet to come up to its 115,000-unit-a-week level of December, but it may do so soon, as a result of late January weather developments.

The industry stubbed its toe on the zero cold wave during the last week of January. Natural gas supplies to key Detroit plants were closed off, and the factories involved had to close for about a full week. This bit into output, of course, but at the same time made possible some modest inventory-building of bottleneck steel. As a result, some new postwar manufacturing marks may be established during February and March, eclipsing the December totals. The inventory build-up, moreover, will thrust at least a few months ahead the periodic shutdowns for such purposes.



Automatic Train Control equipment has been installed on the London Midland and Scottish Railway line from London to Southend (Essex). The unit, comprising permanent magnet and electro-magnet, is intended to provide a warning to the driver about 200 yards before reaching a signal. If the signal is "off" a horn blows for 1½ seconds before reaching it. If the signal is "on" the horn continues to blow until shut off by the driver. Three seconds after the horn begins to blow a progressive brake application commences, this being arranged so as to bring the train to a standstill at the home signal. If the operator should be unable to take the brake application into his hands, the train would come to a complete stop. The train can continue if the operator acknowledges the horn by pressing the cancelling plunger. This view shows the suspension of the automatic train control receiver below the locomotive

1948 Models in Production

Most of the 1948 models are on the production lines today. Independents have all introduced (except for Kaiser-Frazer, which is continuing its earlier lines); the face-lifted Chevrolets and Pontiacs have been unveiled, as has the Buick and its new automatic transmission. Cadillac and Olds introductions are close at hand; these two makes will offer revamped body shells whose lines follow the accepted pattern trails blazed by Hudson, Kaiser-Frazer, Studebaker, and Packard.

In the Chrysler family, no 1948 models as such are planned. Lincoln is now down for changeover, pointing toward March introduction. Mercury will follow, and Ford will come along during the late spring or early summer.

Office of Industry Cooperation Taking Shape Under J. C. Virden

WASHINGTON—The Office of Industry Cooperation, child of the Republican anti-inflation program, is starting to take shape. John C. Virden, Chairman of the board of John C. Virden Co., Cleveland, and wartime regional director for WPB in Cleveland, is director of the new office and holds the rank of special assistant to the Secretary of Commerce.

Appointments to the various divisions of OIC are coming in more rapidly every day and should be completed shortly. Horace W. Reid is being borrowed from the State Department to fill the post of chief legal advisor. He is a law partner of John Foster Dulles.

Mathias W. Niewenhous has been assigned to organize the building materials negotiations department. Formerly with WPB, he was in the construction business previously.

Labor Advisor Not Named

The post of labor advisor is still open, but meanwhile Ralph Hetzel of the Office of Program Planning in the Commerce Department is acting in that capacity. Former research director for CIO, Hetzel, during the war, was deputy vice-chairman of WPB's division on manpower requirements.

Earl Clark, former director of the Department of Commerce's Division of liquidation, has been put in charge of industrial mobilization, Carl L. Foutz, until his retirement a year ago from the U.S. Rubber Co., is Virden's special assistant on industry relations.

Steel Executives Appointed

Three prominent steel executives have been appointed by Secy. Harriman to serve as consultants to Virden's office. They are: David Austin, vice president, U.S. Steel; Walter Watson, vice president, Youngstown Sheet & Tube, and J. K. Beeson, executive vice president, Pittsburgh Steel Co. These industrialists will serve in a part-time advisory capacity, appearing as they are needed. The job of full-time special advisor to Virden is still open.

Banker Special Consultant

Augustus K. Tigrett, an investment banker with considerable experience in the field of transportation, holds the post of special consultant on transportation. Another special consultant is Clifford A. Hahn. His field is to be industrial machinery, including farm, petroleum, mining, industrial, transportation and other equipment.

Tool Accessories Shown by Firms

NEW YORK — Fourteen manufacturers of cutting tools and machine tool accessories exhibited products at the showrooms of Rudel, Carey & Briggs, Inc., here recently.

The three-day exhibit was well received. The exhibitors were:

Charles H. Besly & Co., Boyar-Schultz Corp., Chandler Tool Co., Consolidated Diamond Tool Corp., Criterion Machine Works, Dumore Co., LeMaire Tool & Mfg. Co., McCrosky Tool Corp., Motch & Merryweather Machinery Co., Ready Tool Co., Union Twist Drill Co., Weldon Tool Co., Wesson Co. and Zagar Tool, Inc.

WAA Plans Auctions

WASHINGTON—Three plants have been selected by War Assets Administration to start off a program of public auction of certain surplus industrial property to accelerate disposals.

The three plans are located in Toledo, Harrisburg, Pa., and Rochester, N. Y.

The firm of Joseph P. Day, Inc., of New York, has been engaged to conduct the initial tests of disposing of such surplus plants by auction.

U. S. Firm Buys Japanese Steel

LOS ANGELES—Yaras & Co., Los Angeles import and export firm, has purchased 25,000 metric tons of steel made in Japanese mills from Boeki Cho, the Japanese Board of Trade.

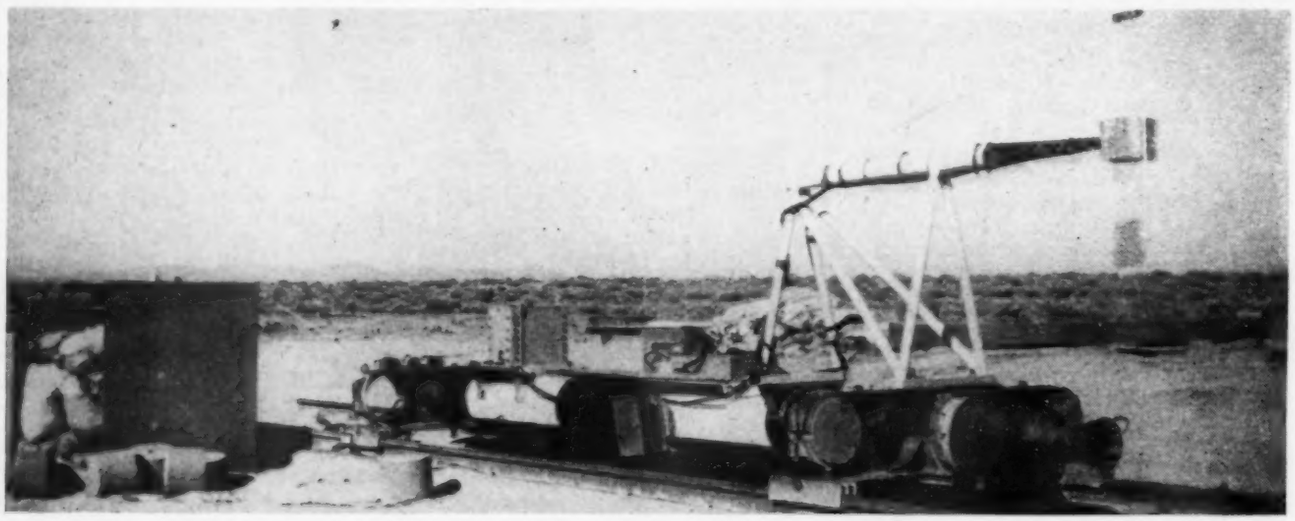
Approved by Supreme Command Allied Powers, the contract provides for delivery of 20,000 tons of light gage hot rolled sheets and 5,000 tons of galvanized sheets, beginning in April. Options for additional tonnages are included in the agreement.

No announcement was made as to the selling point of the steel, the principals buying or the price paid.

In another contract with Boeki Cho, Yaras is supplying Japanese industry with 30,000 long tons of Canadian coking coal, having made the first shipment early in January.

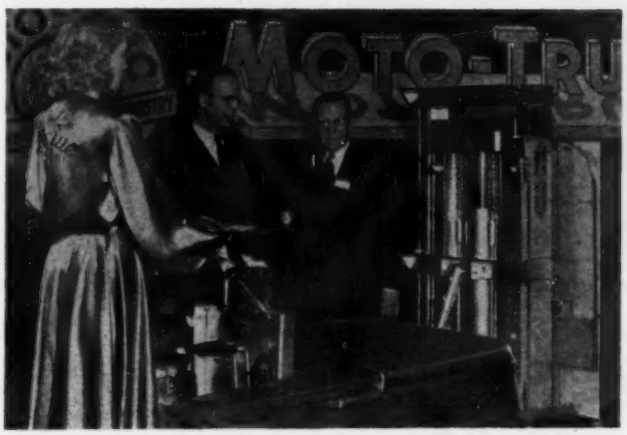
R. J. S. Pigott Heads SAE

CHICAGO—R. J. S. Pigott, chief engineer, Gulf Research Development Co., Pittsburgh, was elected president of the Society of Automotive Engineers at the annual meeting here Jan. 12-16.

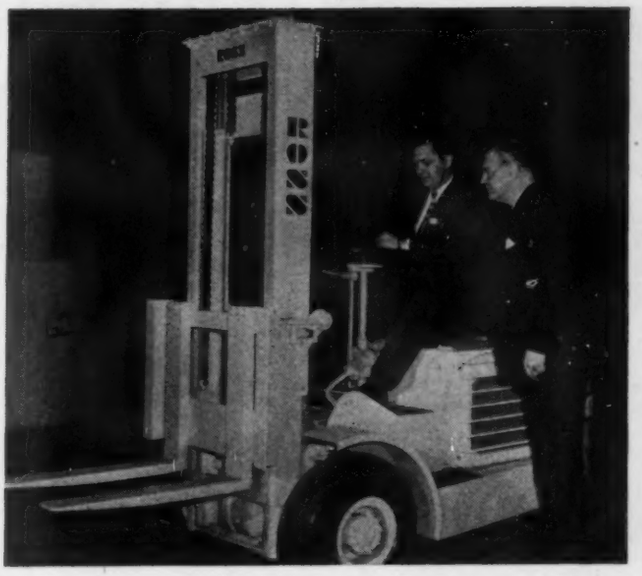


Rocket-Powered Sled Hurtled over tracks at the Army's Muroc Air Base at 1,019 mph. The vehicle was designed to determine feasibility of an "outdoor wind tunnel" for testing aircraft models at supersonic speeds. Boom at front holds model wing which was tested in the high speed

Highlights of Materials-Handling Exposition

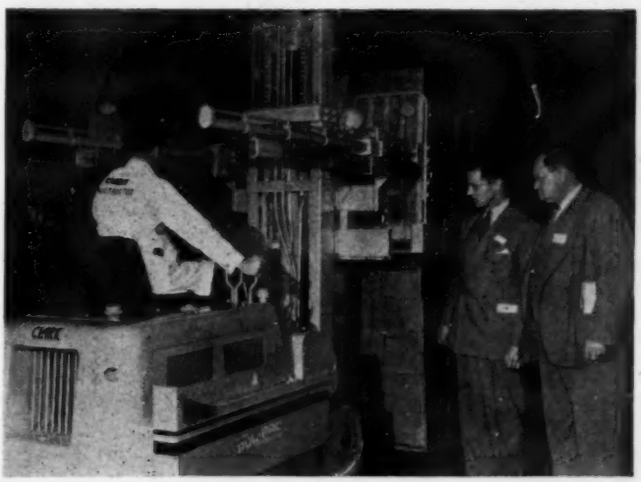


Moto-Truc "Silver Queen," rated at 4,000 lb. at 30 in., has an extendable base that carries operator and batteries to provide counterbalance to load. John Eaton, mats. handling supt., Resinous Product and Chemical Co., discusses its advantages with E. L. Beisel, vp., Moto-Truc Co.

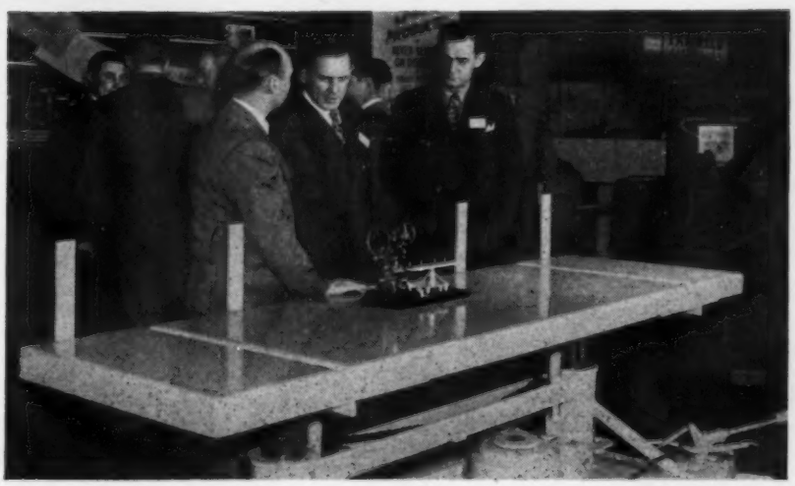


Ross gasoline-powered fork truck with front-wheel drive and rear-wheel steer is rated at 5,000 lb. at 15 in. Good visibility and sturdy construction, as stressed by M. B. Dicky of Ross-Carrier Co., has "sold" H. H. Buchanan, Lima Locomotive Works

Rapids-Standard Forge-veyor, as explained to K. Segalowitz, Stadler Hurter & Co., by John C. Baxter, planning mgr., Rapids-Standard, is intended for carrying hot forgings and castings. The horizontal feeder section is made low to get under presses; belt speed is 65 fpm.



Clark improved Pul-Pac unit with horizontal hydraulic cylinders with hydraulically actuated jaws handles palletless unit load on corrugated paper sheet while J. H. W. Conklin, sls. mgr. of Clark, and W. A. Kelly, mgr. of transportation dept., Willys-Overland, watch the "push" action

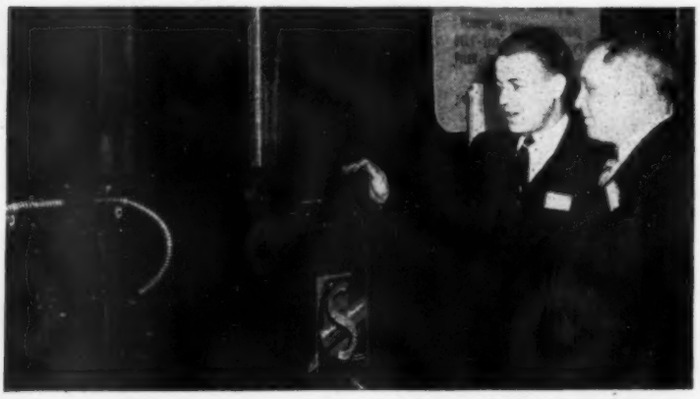


Lyon-Raymond 6,000-lb. sheet-feeding table with hydraulic elevation to keep sheet at press-bed level carries a model setup that holds the attention of W. L. Pick, asst. sls. mgr., Lyon-Raymond Corp., and A. J. Sobey and Al Krasinski, U.S. Air Compressor Co.

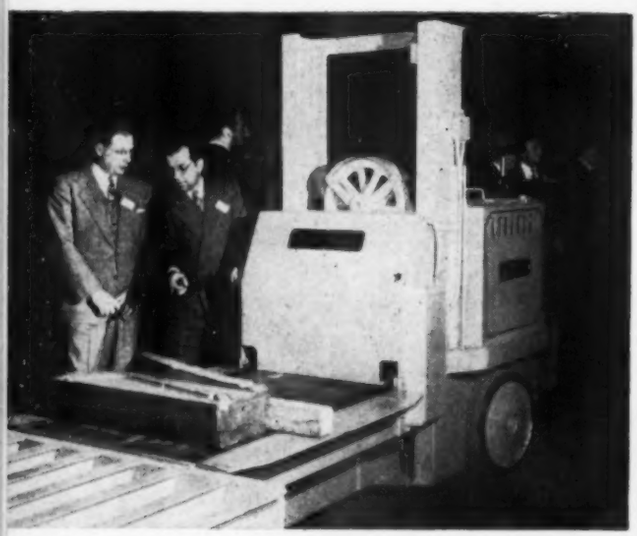
HIGHLIGHTS OF MATERIALS-

Elwell-Parker combination lowlift platform crane truck has 2,000-lb. crane and 6,000-lb. platform capacity. W. A. Meddick, vp., Elwell-Parker Electric Co., demonstrates the 180° swing to J. H. Lenaerts, ch. ind. eng., Union Bag & Paper Co.

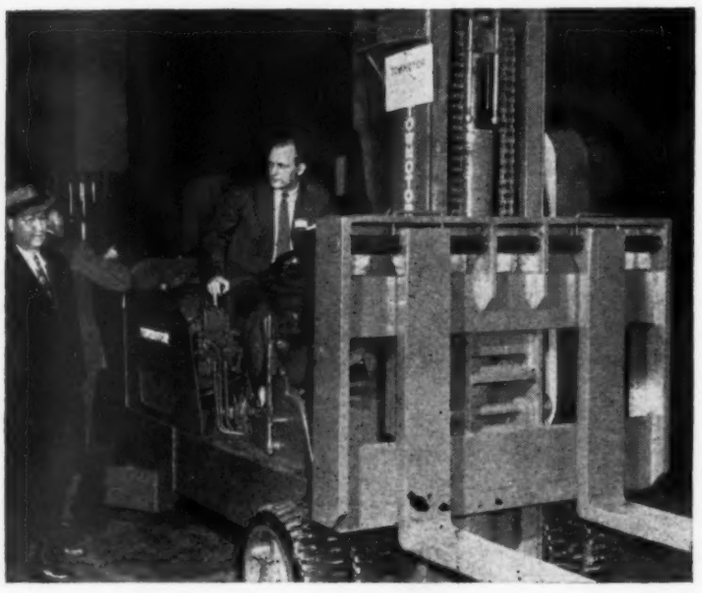
Crescent "Aisle-Saver" electric fork truck, designed for right-angle stacking from 8-ft. aisles to save storage space, is the center of interest for R. E. Clark, vp., Crescent Truck Co.; W. J. Dickey, mgr. operating dept., and A. S. Kellog, asst. to pres., New York Dock Co.; James Krause, ch. engr., Crescent. Harry Keefer, Crescent service mgr., is in the driver's seat



Standard Handi-Drive makes it possible, as told to C. Petosky of Automotive Rubber Co. by E. E. Boberg, gen. sls. mgr., Standard Conveyor Co., to engineer a complete installation from stock parts and to convert a roller conveyor to belt or live roller. The drive has two rubber rollers for belt traction; no takeup needed

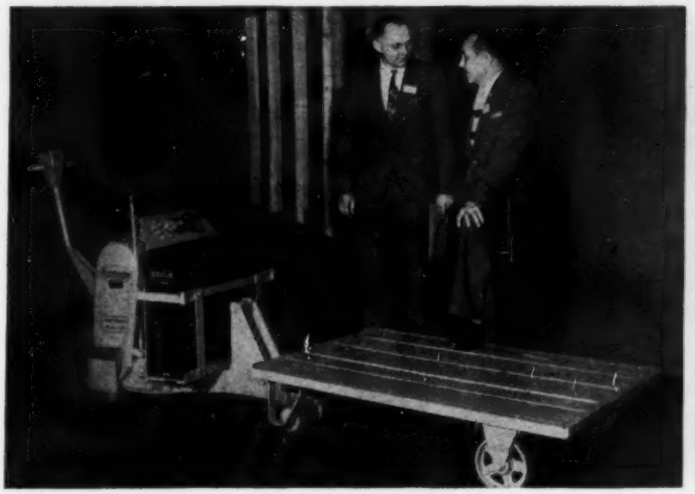


Mercury die-handling attachment, pushers of which operate independently up to 10 fpm. forward and back and retract into body so truck can be used for platform service, is demonstrated to John Payton, Burlington, Ia., by O. T. Henkle, Jr., asst. sls. mgr., Mercury Mfg. Co.

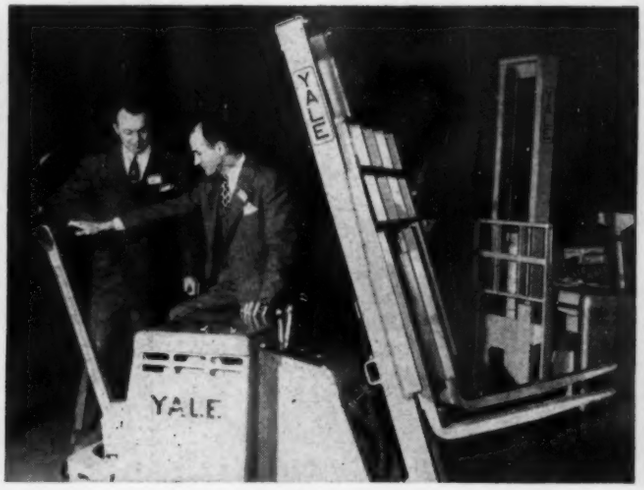


Towmotor model LT-90 (15,000-lb. capacity) is looked over by C. W. Smith, development engineer, U.S. Rubber with H. Kennath, service rep., of Towmotor Corp., demonstrating. Truck data: 74- or 104-in. lift, 3° forward and 10° backward tilt, 90-in. wheelbase, 5½-mph. speed

HANDLING EXPOSITION

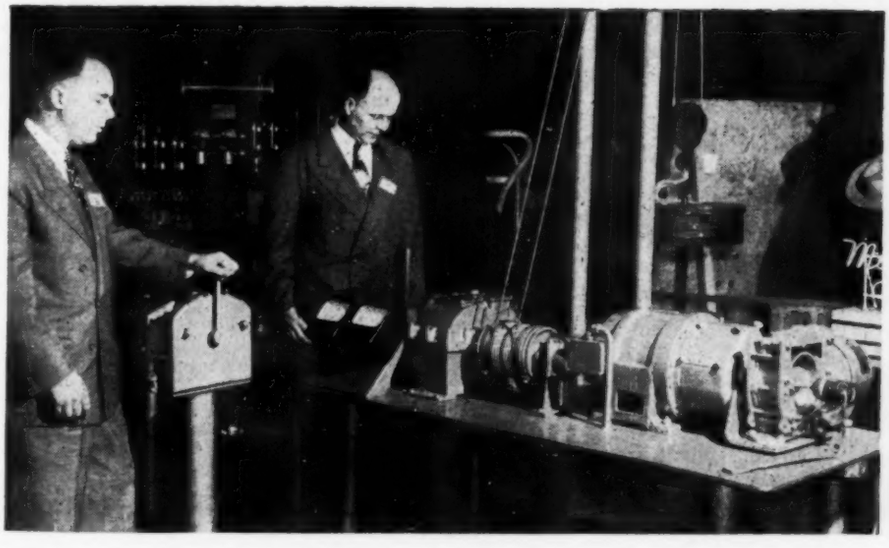


Automatic Transtractor with 4-in. hydraulic-ram lift for handling semi-live and live skids is subject of earnest talk between John Drotos, tractor repair supervision, Republic Steel Corp., and Emmet Jahn, sls. eng., Automatic Transportation Co.



Yale & Towne tilting high-lift motorized fork truck, rated at 2,000 lb. at 48-in. load length, has 60-in. lift and 21° back tilt. Lloyd E. Foster, bureau of merchandising, Armstrong Cork Co., has operation explained by Wm. K. McGreevy, assoc. dir. of field activities, Yale & Towne

Baker 1,000-lb. fork truck, model FQH-10 (weight 2,805 lb.), for use with low floor and elevator capacity is demonstrated by Blake C. Hooper dist. rep., Baker Industrial Truck Div., to F. A. Brickley, supt., of stores, Narragansett Electric Co., and R. J. Daniels, general storekeeper, New England Electric System



Hyster mechanical side shift for quick, accurate spotting of loads is shown by Philip Hill, gen. sls. mgr., Hyster Co., to M. Singleton, supt. of stations, New York Central Systems. This 2,000-lb. truck attachment gives a 12-in. shift with stop at center position

P&H Magnetorque crane control, consisting of rotor and a stationary field member through which braking forces are exerted electromagnetically, is demonstrated by G. W. Bowman, dist. mgr., Harnischfeger Corp., to C. D. Rockwell, ch. eng., Ohio Locomotive Crane Co.

Second-Quarter Tinplate Quota For Export Cut

WASHINGTON—The tentative government export quota of tinplate for the second quarter of 1948 falls 47% short of estimated minimum requirements abroad.

The 112,000-net-ton quota, set by the Office of International Trade and outlined to the Tinplate Advisory Committee, is a reduction of 8,000 tons from the current quarter. Military stockpiling and continued heavy domestic demand are the two reasons given for this low quota.

Approved foreign orders for the 112,000 tons must be accepted by tin mills. An additional 13,000 tons may be licensed on a non-rated basis, 5,000 tons of which would be for food packed abroad for import to the United States. The remaining 8,000 tons would be for uses permitted by tin conservation order M-43, and for overseas use by American petroleum companies. Licenses for these 8,000 tons would be restricted to electrolytic tinplate (maximum .50-lb. coating) ore special coated manufacturing ternes. This 13,000-ton figure would produce a further export reduction from the first quarter by 9,000 tons.

H. B. McCloy, director of the Office of Materials Distribution, is currently engaged in tin conservation studies and discussions with industry groups.

Stalingrad Today—Part of the engine plant of the Dzerzhinsky Tractor factory is shown in the upper photo. Tractors being assembled on the main conveyor are seen on the right

Australia Pushes On Machine Tools

MELBOURNE—In the year ended June 30, 1946, Australia produced 485,299 pounds worth of lathes and 738,676 pounds worth of other machine tools, a total dollar equivalent of about $4-million, according to a monograph on metallurgical and metal-working industries issued by the Commonwealth Statistician. The Commonwealth had a total of 2,340 establishments with a combined payroll of 74,992, a drop of 18,000 from the 1942-43 employment peak but an increase of 30,000 over 1938-39.

While in 1938-39 more than three times as much new plant equipment was installed than was written off, new installations failed to catch up with depreciation during the war years. The trend was again reversed in 1945-46, the first postwar operating year, when additional plant and replacements were valued at 2.1 million pounds while depreciation was estimated to have caused a capital loss of 1.7-million pounds. These figures refer to plant and machinery only and do not include land and buildings.

Ford Seeks Heavy Goods on Coast

LOS ANGELES—Preliminary negotiations are under way in the Ford Motor Co.'s West Coast parts-buying program for the purchase of heavy goods, such as body parts and frames, fenders and gas tanks.

The company has successfully concluded $35 million worth of contracts for small goods in the nine months since it announced it planned to buy $60 million worth of parts and components annually in the West.

However, in the words of a company spokesman, the Western buying program won't really be a success until Ford can buy on the coast—near its Richmond, Long Beach and Los Angeles assembly plants—the bulky, costly-to-ship items like fenders, bodies and frames. At present the nearest to the "heavy parts" classification are purchases of chassis spring, bumpers and wheels.

Three new contracts, totaling nearly $2 million a year were signed in January with three Los Angeles-area firms. The Cannon Electric Development Co. contracted to make $1,400,000 worth of ornamental die castings and horns, the first instance of a Western industry delivering die castings already polished and plated on a large scale. Bendix Aviation Corp.'s Pacific division will make $400,000 worth of master brake cylinders and the R. H. Osbrink Manufacturing Co. will make $100,000 worth of aluminum castings.

Pakistan to Announce New Policy on Imports

KARACHI, Pakistan (McGraw-Hill World News)—Faced with acute shortages of many essential goods, the government of Pakistan soon will announce a revision of its import policy—which at present is the same as India's as a result of a "stand-still" agreement.

Basis of the trouble is two-fold. First, many of these items used to arrive in Pakistan from India or by way of ports which now lie within the Indian Dominion. Second, trade in these items and in others which entered Karachi (Pakistan's major west coast port) was largely in the hands of Hindus. Now almost all of these traders and importers have fled to India.

It is now expected that machinery and other essential items will be placed on the free import list.

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American Machinist REFERENCE BOOK SHEET

Process Sheet for Cadmium Plating

BY GEORGE BLACK

Because of its relatively high price, cadmium is usually used indoors or in protected areas where thin coatings will suffice. However, aircraft, marine and military outdoor uses are common because of the high degree of corrosion resistance offered. Cadmium coatings are attractive but relatively soft; they are resistant to alkalies and are therefore used to protect washing equipment and steel embedded in concrete. The electrical industry has made wide use of cadmium because it is easily soldered and has good conductivity. Simple dip after-treatments assure good paint adhesion.

DEGREASER

Various types of cleaners are available for the removal of loose dirt, grease and oils. Petroleum solvents, chlorinated solvents and solvent emulsion cleaners have all been used. Present trend for production line work seems to favor vapor degreasing using trichlorethylene and perchlorethylene vapors.

RINSE

CLEANER

In widest use today are the various alkali soak cleaners which are used at elevated temperatures. Higher temperatures increase cleaning speed, and present trend is toward high conductivity cleaners which permit cathodic and anodic cleaning.

RINSE

PICKLE

Pickling operations are used for the removal of scale and rust. Industry seems divided between the use of sulphuric and hydrochloric acid. The action of HCl at room temperature is more rapid, but sulphuric acid is lower in cost. To minimize attack on the base metal, many proprietary inhibitors are widely used.

RINSE

PLATING

Cadmium plating is conducted almost exclusively through the medium of cyanide baths. Addition agents are added to produce bright or semi-bright deposits. The solution is operated at room temperature with cadmium bars or balls as anodes. Steel tanks may be used but rubber-lined tanks are recommended.

RINSE

AFTERDIP

To secure good paint adhesion, cadmium coatings are usually dipped in dilute chromic acid or in various proprietary chromate or phosphate solutions. Clear dips are available for coatings which are not to be painted; it is claimed that increased corrosion resistance can be obtained.

RINSE

highest production with indexing fixtures

Cost per piece can in many cases be materially reduced thru the introduction of surface broaching with indexing fixtures. Parts like the ones illustrated are produced with higher production per man-hour and lower tool maintenance costs than with former machining methods. We will be glad to work with you on the possibility of using Footburt machines on your work. Just send blueprints of your parts with the number of pieces required per hour.

THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

Detroit Office: General Motors Building

FOOTBURT *Surface Broaching*

FOOTBURT PATENTED TOOTH FORM

American Machinist

REFERENCE BOOK SHEET

Methods for Mounting Cutters

COURTESY GIDDINGS & LEWIS MACHINE TOOL COMPANY

A large proportion of milling operations on a horizontal boring, drilling and milling machine can be accomplished by mounting the cutter either directly on the machine spindle or spindle sleeve. This can be done without any other form of external support.

Because of their simplicity, five such types of mounting are more quickly made than setups requiring support and hence are preferable when they meet the requirements of the operation. These types are:

1. Small cutters, like end mills, often have an integral Morse taper shank. By using an adapting sleeve, Fig. 1, the tool is conveniently and quickly mounted in the spindle.

2. A widely used design of inserted-tooth cutter is equipped with an integral shank. Whereas the small milling cutter with integral shank must ordinarily be used with an adapting sleeve, the size of the inserted-tooth cutter warrants an integral shank large enough to fit directly into the spindle socket, Fig. 2.

3. The use of an arbor to mount cutters with center holes is a standard arrangement, Fig. 3. The arbor is precision made to achieve rapid and accurate positioning of the cutter.

4. Conversion adapters, as in Fig. 4, permit cutters to be mounted in spindles of several types of machine tools operated in the average shop.

5. Face-milling cutters larger than 6 in. dia. are often connected to the machine-spindle sleeve. The mounting shown in Fig. 5 gives added rigidity to withstand the deflecting pressures and shock of heavy milling cuts. A centering arbor is assembled into the spindle socket to locate the center hole of the cutter. To secure the cutter, machine screws pass through holes in the cutter body and enter the spindle sleeve to supplement a nut on the end of the arbor. Radial keys lock the cutter to the spindle sleeve and provide a positive drive.

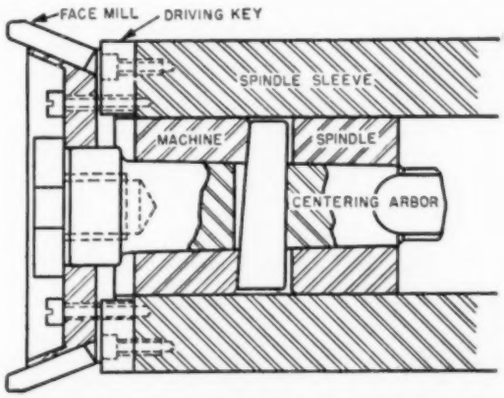

Fig. 5—Rigid mounting of large cutters is obtained by centering them in the spindle with a centering arbor and fastening the cutter body to the spindle sleeve. Radial keys provide a positive drive for the cutter

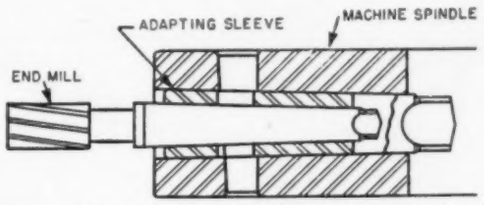

Fig. 1—How a small cutter with integral shank is adapted to the machine spindle

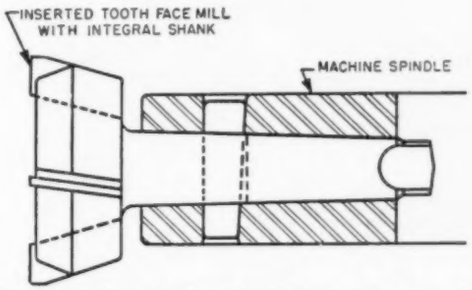

Fig. 2—An inserted-tooth milling cutter usually has an integral shank large enough for direct mounting in the spindle

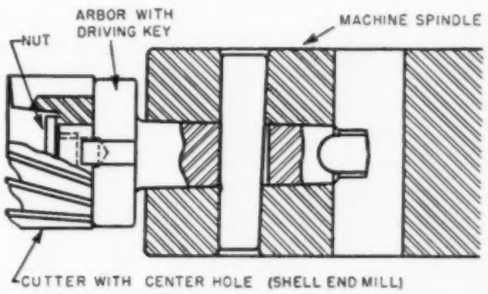

Fig. 3—Cutters with a center hole can be fastened to an arbor with driving key and nut

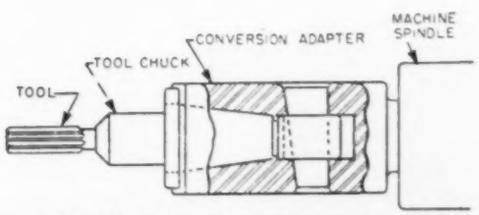

Fig. 4—Combination of a tool chuck and a conversion arbor permits tools of wide utility to be mounted in the spindles of several machines having different spindle connections

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Speeds and Feeds for Boring

COURTESY GIDDINGS & LEWIS MACHINE TOOL COMPANY

In many respects, boring and turning operations are similar, but boring speeds are somewhat slower than turning speeds, tool-for-tool on a given workpiece. Rigidity favors turning operations. In certain types of boring, lack of bar rgidity may require reduction of either speed, feed or depth of cut. Bar size and distance from the cutter to source of support or supports largely determine rigidity in boring operations.

Chip interference with the cutter is more pronounced with boring than with turning operations. This interference can reduce effective tool life unless slower machining rates are used to compensate for this effect.

The several variables peculiar to boring operations result in a wide range of applicable speeds and feeds. The conservative values tabulated may be increased in many cases. Lower values however, must be used for hard and tough materials: high- carbon tool and die steels, alloy steels, heat-treated steels.

BORING OF STEEL WITH HIGH-SPEED STEEL CUTTER*

	Type of Hole	Tolerance (Inches)	Speed (fpm)	Feed (In. Per Rev.)	No. of Cuts
Flycutter in Stub Bar	Cored or Cut	.001–.003	30–40	.010–.020	4
	Cored or Cut	.003–.010	30–40	.010–.020	3
	Cored or Cut	.010–.030	30–40	.010–.020	2
	Drilled Hole to Be Reamed		30–40	.012	2
Flycutter in Boring Head Mounted on Line Bar	Cored or Cut	.001–.003	30–40	.015–.030	4
	Cored or Cut	.003–.010	30–40	.015–.030	3
	Cored or Cut	.010–.030	30–40	.015–.030	2
Block Type Double Cutters Stub Bar	Cored or Cut	.001–.003	30–40	.020–.040	3
	Cored or Cut	.003–.010	30–40	.020–.040	2
	Cored or Cut	.010–.030	30–40	.020–.040	1
Block Type Double Cutters Line Bar, Fixtures, etc.	Cored or Cut	.001–.003	30–40	.025–.050	3
	Cored or Cut	.003–.010	30–40	.025–.050	2
	Cored or Cut	.010–.030	30–40	.025–.050	1

*Cemented carbide feeds are the same as shown for high-speed steel. Speeds may be increased to 200-400 fpm.

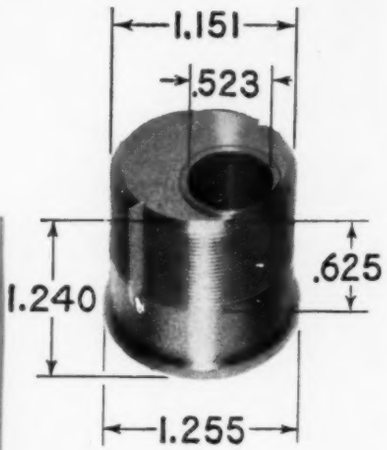
BORING OF CAST IRON

	Type of Hole	Depth of Cut, Radius (Inches)	Speed (fpm)	Feed (In. Per Rev.)	No. of Cuts
Flycutter in Stub Bar	Cored Hole to .005 in., Tolerance	3/8 max.	40–45	.012–.016	3
	Cored Hole to .0005 in., Tolerance	3/8 max.	40–45	.012–.016	4
	Drilled Hole to Be Reamed	1/16 max.	40–45	.012	2
Flycutter in Boring Head Mounted on Line Bar	Cored				
	Rough	1/4–3/8	35–40	.012–.025	
	Semi-finish	1/16	35–40	.035–.050	
Block Type Double Cutters, Fixture Support	Cored				
	Rough	1/4–3/8	35–40	.019–.025	
	Semi-finish	.018	35–40	.031–.050	
	Finish	.007	35–40	.031–.050	

NEW BRITAIN AUTOMATICS LOWER BREAK-EVEN POINT ON THIS PIECE...

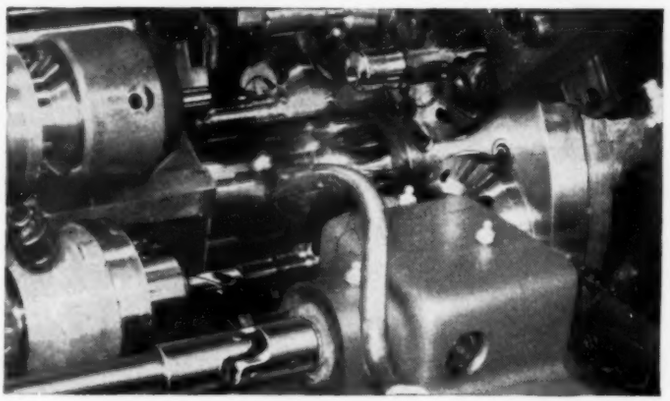
By

Eliminating 2nd operations
Reducing time and labor costs
Increasing production rate over 100%
Improving quality of product
Reducing material cost



A leading manufacturer formerly turned out the lock cylinder case illustrated from castings on five separate machines, each of which required a full time operator. Searching for more profitable production, he decided to investigate the possibility of automatic machinery.

By stopping the spindles and using eccentric drilling, plus milling attachments, New Britain engineers were able to put the entire job on one of our new model 601 Automatics using bar stock instead of costly castings. Production is maintained at 613 pieces per hour (5.8 secs. per piece), and the operator can easily take care of two other machines.



Eight operations plus cut-off are necessary to complete the piece. The spindle is stopped in the 4th position where the V slots are milled while the eccentric drilling attachment drills the main cylinder hole. Because specifications require the closest alignment between the two slots and the eccentric hole, the spindle is indexed to the 5th position without changing the alignment. In the 5th position the main cylinder hole is reamed while a cutter faces the end of the piece leaving a shoulder around the hole.

For a practical solution to mounting manufacturing costs . . . let New Britain engineers point the way to lowering the break-even point in your plant. Write today for your copy of "Cost Histories" which describes many specific approaches to more economical manufacturing.

Productivity, not price, is the measure of a machine.

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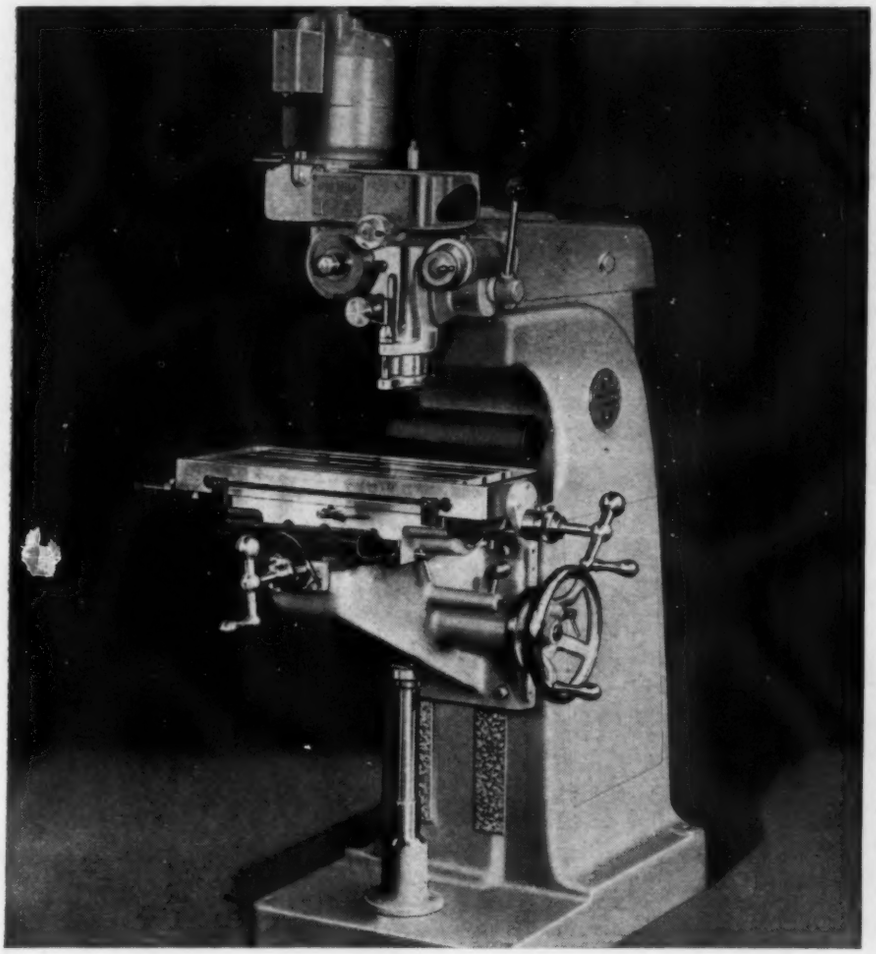
Shop Equipment News



Gorton Super-Speed Milling Machine Offered with Swivel, Universal Head

A super-speed milling machine with either a swivel or universal head, listed as model 0-16A, is offered by George Gorton Machine Co., Racine, Wis., to replace the former model 8-D fixed-head vertical milling machine.

Design permits the operator to sit at the machine in a normal position. It is a ram type, hand-feed vertical milling machine with a heavy column, and sensitive table and saddle movements. Machine is provided with a positive spindle brake for instantaneous stopping when changing cutters, a spindle lock which holds spindle in place for setting-up and milling operations, and a screw-type spindle depth stop graduated in thousandths which provides accurate setting of cutter depth. It also provides positive belt-tension adjustment and an adjustable ram.

A safety feature is provided at the swivel and universal joints to overcome slipping or dropping the head which otherwise would damage the machine or workpiece. A quarter turn of the clamp nut releases the joint slightly, allowing the setting of any angle of adjustment desired. Each joint has an oversize face-clamping surface which is said to add to its rigidity and accuracy and to eliminate clamping distortion. The ⅞-in. dia. clamping studs are claimed to assure positive clamping.

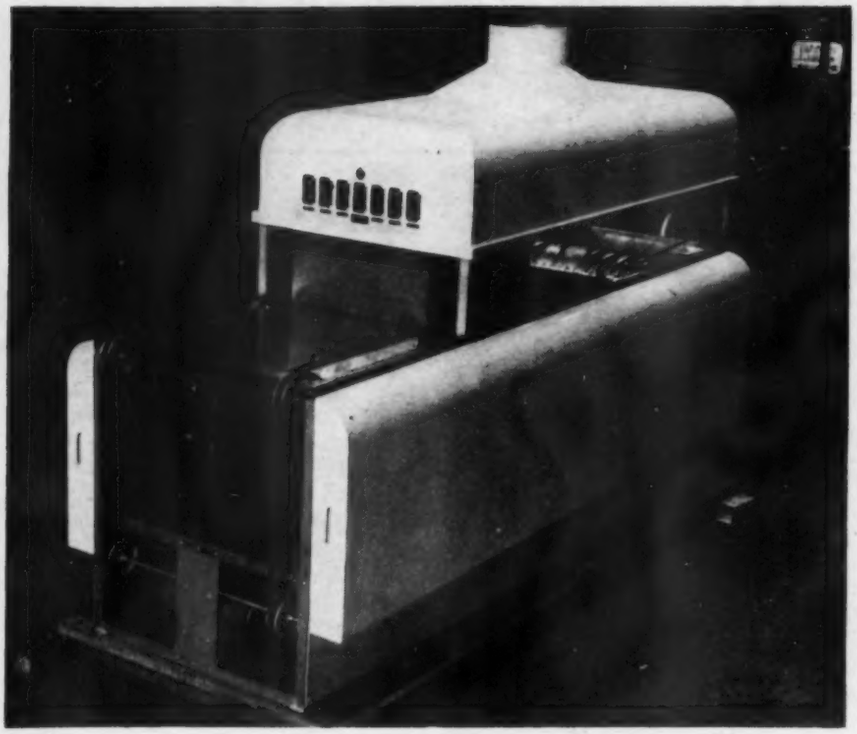
Spindle design features precision bearings permanently grease-sealed. The standard spindle takes the Gorton taper collet and accommodates cutters to ½-in. shank dia. A ½-hp., high-torque, reversible motor providing 6 spindle speeds from 300 to 5,000 rpm. is used. Speeds from 600 to 10,000 rpm. are available.

Machine is adaptable to general engraving work, brass routing and other light milling operations where maximum cutter visibility is stressed, by the use of a special extension spindle. It is also available as a complete die and mold duplicator.

Sherman's Hand Pallet Truck Operated by Hydraulic Unit

A hydraulically operated hand pallet truck called the Jack-O-Might, with a capacity of 2000 lb., is offered by Sherman Industries Div., Sallinger-Sherman, Inc., 138 Brookline Ave., Boston 15, Mass.

Truck is said to be tested to 10,000 lb. static capacity, and is operated by a standard hydraulic jack unit. Two of the four wheels swivel 360 degrees which permits the truck to be maneuvered in close quarters. Truck will handle all standard pallets and has a lift of 2½ in.



Koch Automatic Gyra-Flow System Cleans and Finishes Small Parts

George Koch Sons, Inc., P. O. Box 358, Evansville 4, Ind., introduces the Gyra-Flow automatic finishing systems, capable of two to 20 processes in any continuous sequence. A series of cylinders in sequence, each spirally wrapped with a variable number of turns of the conveyor belt, provides continuous rotation and therefore agitation of air and liquid.

Loading can be manual or automatic from either end. Sequence includes: cleaning, washing, rinsing, drying, dipping, drying, spraying and baking. During the first drying, temperatures to 500 F. are available. During baking, high or low temperatures at any humidity are available from periods of 1 min. to 1 hr. or longer. Work cools on returning to opposite end and is finished and ready to pack.

Interchange of operations and progressive sequence can be altered. Timing of each operation can be regulated by the driving mechanism, or the number of turns of the conveyor belt around each cylinder. Speeds range from 4 to 12 fpm.

Die-Casting Machines by DCMT Casts Aluminum, Also Zinc

A die-casting machine for both zinc and aluminum called the Two-Pounder is offered by DCMT Sales Corp., Beach 79 St. at Bay, Rockaway Beach, N. Y. Aluminum can be cast as rapidly as zinc with this machine. Production rate for each metal is about 350 shots per hr.

The change-over from zinc to aluminum die casting can be made without the use of the hand ladle for each shot in aluminum. Capacity is 2 lb. on zinc and 1 lb. on aluminum, on 12x18-in. standard die blocks. All four sides are open for core pulls or placement of insets. Machine is pneumatically operated; controlled from one toggle switch.

Toolweld A & O Electrode Available in Three Sizes

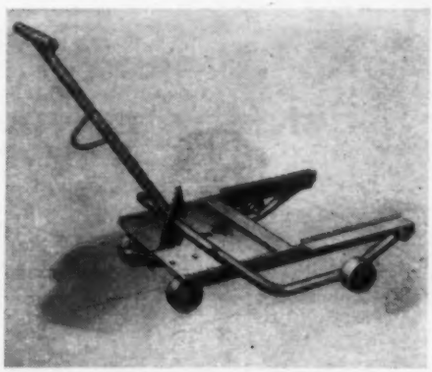
An electrode, Toolweld A & O, ("A" for air-quench, "O" for oil-quench) for hard surfacing tools and dies, is introduced by Lincoln Electric Co., Cleveland 1, Ohio. It is for use in building up the working surfaces or edges of cold-working metal cutting and forming tools. Electrode will operate on either ac. or dc. and is made in 3/32, ⅛, and 5/32-in. sizes.

Machine Employing Flexible Shaft Drives High-Speed Cutting Tools

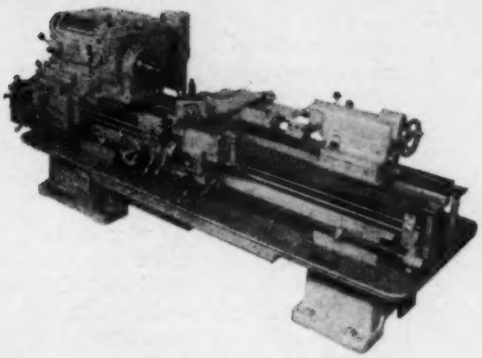
The Electro-Mechano Co., 261 E. Erie St., Milwaukee 2, Wis., announces the Speed-Right flexible-shaft machine which will drive midget mills, rotary files, burs, drills, and other carbon and high-speed steel cutting tools at the proper cutting speed. Unit is said to maintain the proper rpm. under both load and no-load conditions, and also not to slow down when put to work.

Positive speed control gives reduced speeds while maintaining maximum motor torque. Speed ranges are from 1000 to 10,000 rpm., or if specified, from 2500 to 15,000 rpm. The proper cutting speed is said to remain constant without further adjustment regardless of whether the tool is cutting or idling.

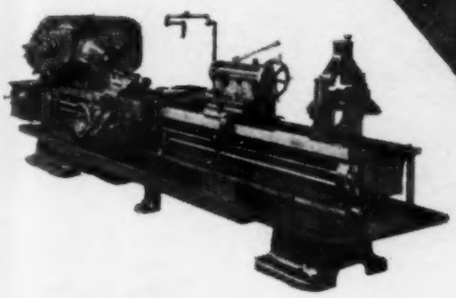
Unit is powered by a 1/10 hp. ball-bearing motor. Speed control is provided by a centrifugal-force electrical governor mounted in the motor case.



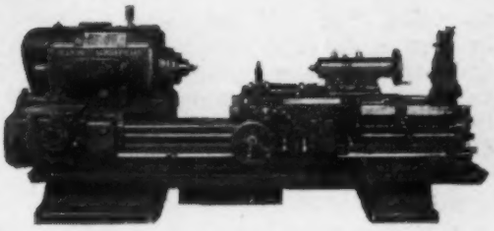
TOTE-PAN lift truck with a capacity of 600 lb., is announced by Lyon-Raymond Corp., 4542 Madison St., Greene, N. Y. Open forks engage the side handle or lip of tote pans and lift load by a downward push of operating handle. An automatic lock holds the load in elevated position and a pedal release controls lowering



MODEL "X"
ENGINE & TOOLMAKERS
LATHES



MODEL "X"
OIL COUNTRY
LATHES



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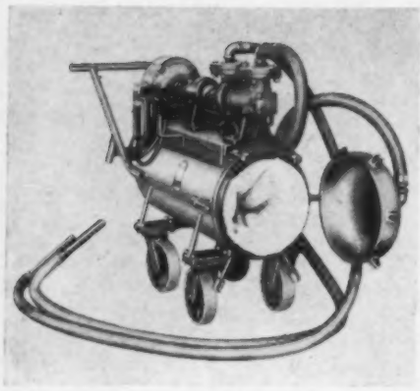
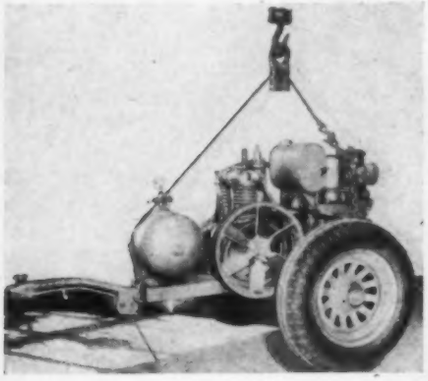


Honan-Crane Coolant Filter Powered by Own Motor, Pump

A mobile machine-tool coolant filter mounted on four 8-in. caster wheels, is introduced by Honan-Crane Corp., 909 Sixth St., Lebanon, Ind. The unit is powered by its own motor and vacuum pump and operates on a continuous circulation arrangement from a suction hose through the filter tank and discharge hose. Flow rate is 12 gpm.

Coolant is processed in the machine sump. Abrasives are said not to enter the pump. A close-woven cloth bag within a perforated metal basket which can be washed in a degreaser and reused, acts as the filtering medium. Entire unit will tilt at a 45° angle. The only controls are starting and stopping switches.



Improved Equalizing Sling Offers Adjust-A-Leg Design

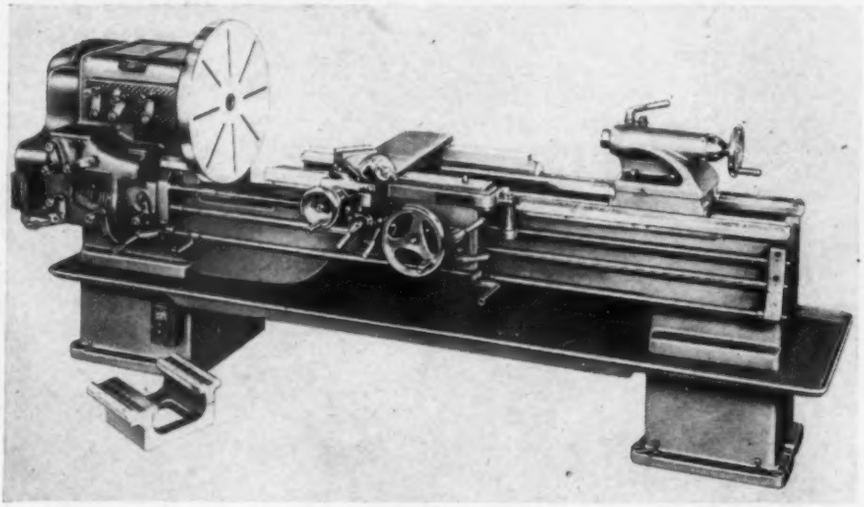
An improved model of the Adjust-A-Leg Equalizing Sling is announced by The Caldwell Co., 1830 Camp Ave., Rockford, Ill. Units are designed to lift odd-shaped and unbalanced loads level or at almost any predetermined angle. Their capacities range from ¾ to 12 tons, with a safety factor of five.

The sling consists of an equalizing unit with a wire rope. The unit is made up of a sheave with a V-shaped groove carried by a spring-mounted axle, and a pair of brake shoes. The rope lies over the sheave in the groove, and has a hook attached to each end, forming two legs.

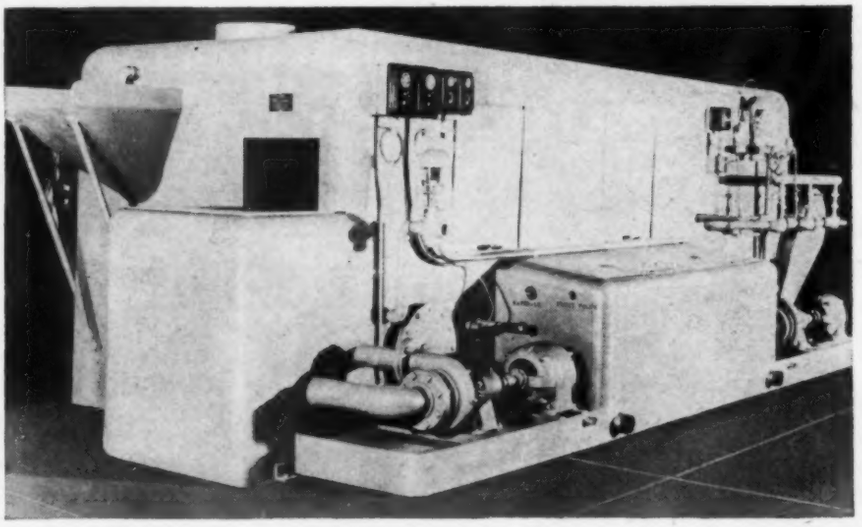
The equalizing unit is placed on a crane hook and spotted by the operator over the approximate center of gravity. Riggers then attach hooks to the load and operator applies hoisting power. Two units may be placed on one crane hook for three- or four-point suspension.

Vi-Speed Foot-Controlled Vise Applicable for Heavy-Duty Work

A heavy-duty air-operated foot-controlled vise, manufactured by Van Products Co., 1521 G. Daniel Baldwin Bldg., Erie, Pa., Model 610 Vi-Speed, has greater mass than their standard model. Larger jaws and wider maximum openings permit the positive holding of larger castings, forgings, and other pieces. Air regulator and gage provide jaw pressures ranging from zero lb. to 50 times available air pressure.



GAP LATHE featuring a 12-speed sliding spur-tooth geared headstock, is made by The Sidney Machine Tool Co., Sidney, Ohio. Lathe is offered in 14-, 16-, 18-, and 20-in. sizes, and is provided with automatic lubrication by a rotary pump and filter. Gear box provides 48 feed and thread changes. Apron is of double-wall construction. Bed is constructed with four longitudinal walls and double braces. Cross braces are spaced at 12-in. intervals

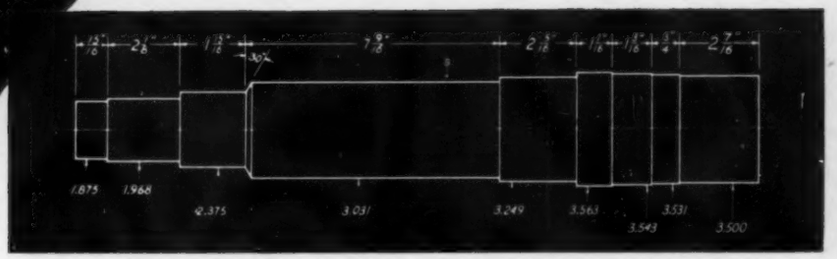


COMBINATION DRUM AND BELT conveyor wash, rinse and dry machine is made by Cincinnati Cleaning & Finishing Machinery Co., Hecla St., Ironton, Ohio. On left is loading hopper into which parts to be cleaned are fed. To the right is loading station for the belt conveyor parts. Small miscellaneous parts are cleaned in the drum; larger and more delicate parts, on the belt. Thermostatic control is provided for both the solution and oven

AUTOMATIC SIZING By MONARCH =

SPEED + SAVINGS IN SHAFT-TURNING

PART PARTICULARS: Steel Shaft, 20⅜" x 3⅝" Diameter. Using carbide tools, turn right end 5⁷⁄₁₆" in 2.49 minutes; left end in 5.26 minutes.



FASTER? YES!

Here's a 20" shaft on which nine diameters are turned in two operations—in a total machining time of 7¾ minutes. That's speed, the Automatic Sizing way. And it takes less than one minute to switch a standard Monarch Lathe over from conventional to Automatic Sizing, or back again. Setups never exceed five to ten minutes.

ECONOMICAL? YES!

Any standard Monarch Lathe (14" or longer) equipped with the Automatic Sizing attachment may be used as a conventional lathe for ordinary jobs, then switched over for special high-speed turning of shafts on a completely automatic cycle, electronically controlled. It's almost as simple as throwing in the overdrive on your car—and you can almost *feel* production zooming. One man can operate two or more machines, *easily*.

That's "Peak Production at a Profit"—as proved in use. More than 400 Automatic Sizing Units are saving time and money in our customers' plants. They'll cut *your* shaft-turning costs, too. May we show you how?

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Monarch TURNING MACHINES

FOR A GOOD TURN *FASTER*——TURN TO MONARCH

Flexible Shaft on Stow Machine Driven by V-Belt Stepped Pulleys

Streamliner flexible-shaft machines are offered by Stow Mfg. Co., Binghamton, N. Y. Shaft is driven by V-belt stepped pulleys. Speed changes and belt adjustment are made by turning an eccentric spindle which is locked in position by a knob.

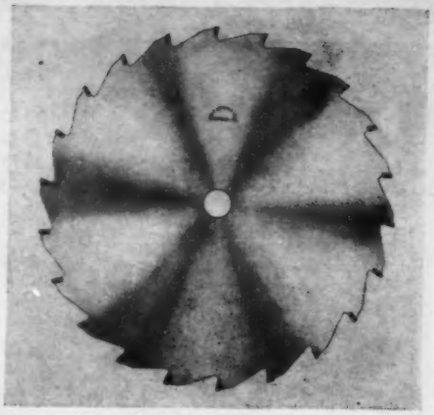
Shaft is 6 ft., and has an oil-resistant casing and coil reinforcement. Its ball-bearing handpiece has a detachable wheel arbor, which is said to give wide adaptability of tools and attachments. Operating mechanism is balanced on its yoke and pivot mounting.

A choice of mounting, power and speed range is offered. Mounting may be pedestal, suspended or low-mount type. Power varies from ½ to 1 hp. Speeds vary from 1150 to 6900 rpm.

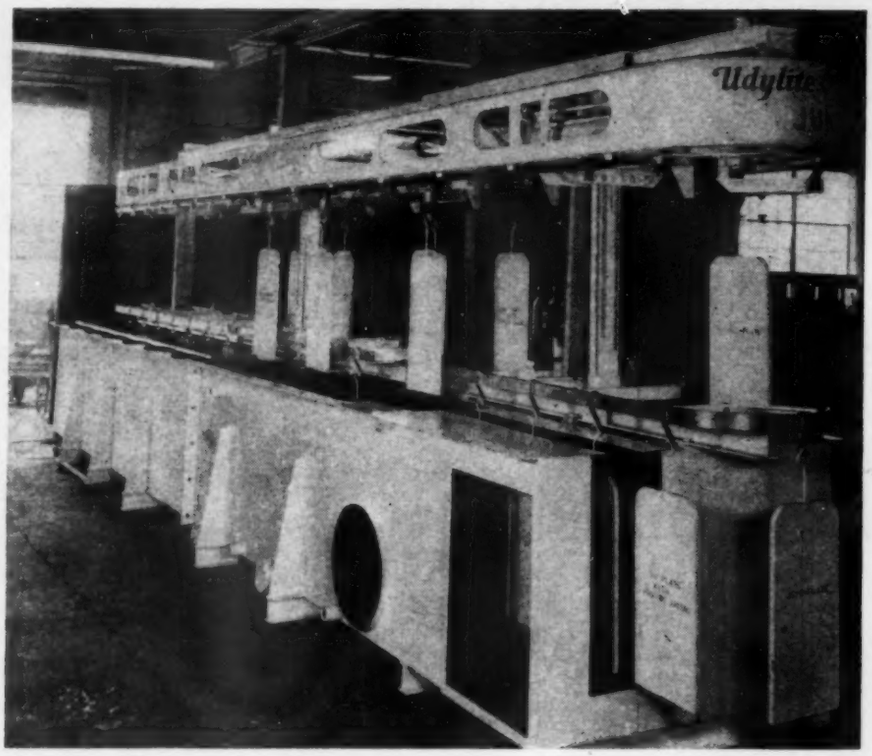
Unionmelt Automatic Welder Employs Flexible 20-ft. Hose

The Unionmelt automatic flexible welder is introduced by The Linde Air Products Co., Unit of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y. This submerged melt welding process is useful for making welds that are inaccessible for fully automatic welding, making short welds where mechanization is not worthwhile, for building up deposits, and for depositing metal to repair weld or casting defects.

The welding nozzle at the end of a 20-ft. long flexible hose, can be moved from one weld to another without stopping to set up track, carriage, or other guiding equipment. The hose, which acts as the connecting link between nozzle and main assembly, contains the welding current cable, and two tubes through which the welding rod and granular material are fed. Bare rod of any size to 5/32-in. dia. in the standard 25-lb. coils can be used. Welder has a capacity of 900 amp., either dc. or ac. The compact assembly is mounted on wheels.



CARBIDE-TIPPED circular saws used for cutting plastics, are made by W. F. Meyers Co., Inc., Bedford, Ind. Line includes both standard and fine-tooth saws, 8- to 18-in. dia.



Udylite's Junior Plating Machine Handles 75 to 100 Racks per Hour

The Udylite Corp., 1651 East Grand Blvd., Detroit 11, Mich., announces the Junior fully automatic plating machine which has no conveyor chains and requires no electrical-timing-control panel or limit switches. Machine handles 75 to 100 racks per hour, has nine stations: electroclean, cold rinse, acid dip, cold rinse, plate, cold rinse, hot rinse, dry, load and unload. Every phase of the cycle can be adjusted.

The Junior can be used for cadmium and zinc plating as well as on other metals. Movement of supporting frame and of the pusher fingers are actuated by two pneumatic cylinders. Overall dimensions are 28½x8½x8½ ft. Rack size is 2 to 6 in. wide, 12 in. long, and 24 in. deep. Tank is 26x36 in. Transfer distance is 16 in. max.

New NAICO A-33 Light Sensitive Multi Driller or Tapper

for drilling or tapping 1/16" to 1/4" holes in small work

IN CAST IRON, STEEL, ALUMINUM, PLASTIC OR WOOD

With or without air operated automatic rotating table

A hit at the Machine Tool Show

The new NATCO A-33 Light Sensitive Machines offer maximum production on light work where super sensitive operations and high speed are of paramount importance. These NATCO machines offer flexible spindle arrangements for up to ten spindles. Spindle speeds from 650 to 3550 RPM are provided by quick change sheave arrangement. Close control and high speed are features of all three models of the NATCO A-33 Machines providing the following feed arrangements: (Model A-33A) Hand and Foot Feed (Model A-33A) Combination Hand and Foot and Air Oil Feed; (Model A-33B) Air Feed. Write Dept. A for NATCO Bulletin 247.

NATCO A-33A Combination Hand and Foot and Air Oil Feed Machine illustrated can be arranged for both light precision drilling and tapping.

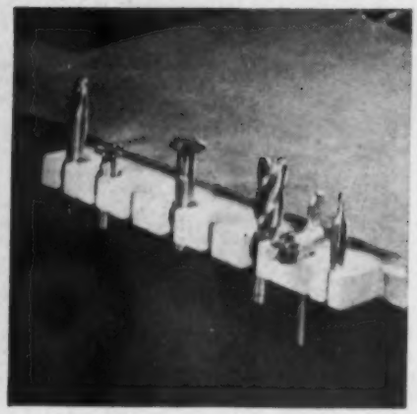
NATCO DRILLING, BORING, TAPPING & FACING MACHINES

NATCO

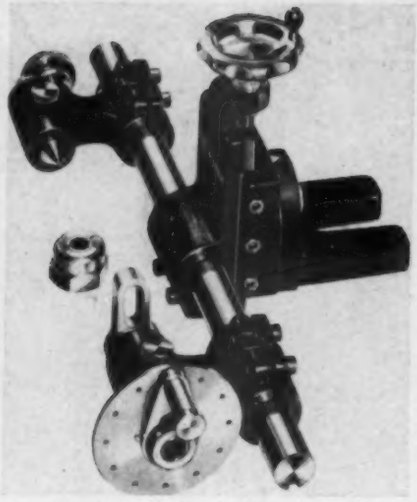
Call a Natco Field Engineer

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.

Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City



SLOTTED HARDWOOD blocks which slide into a shaped aluminum back strip make up the Wizard Toolrak offered by Davis Development Co., 348-74 First National Bank Bldg., Colorado Springs, Colo. Blocks are variously drilled, counterbored and slotted to hold most of the commonly used types of hand tools. Standard back strips range from 8- to 36-in. long, and come in 31 different types of blocks. Since blocks slide into back strip, they can be arranged and rearranged in any sequence

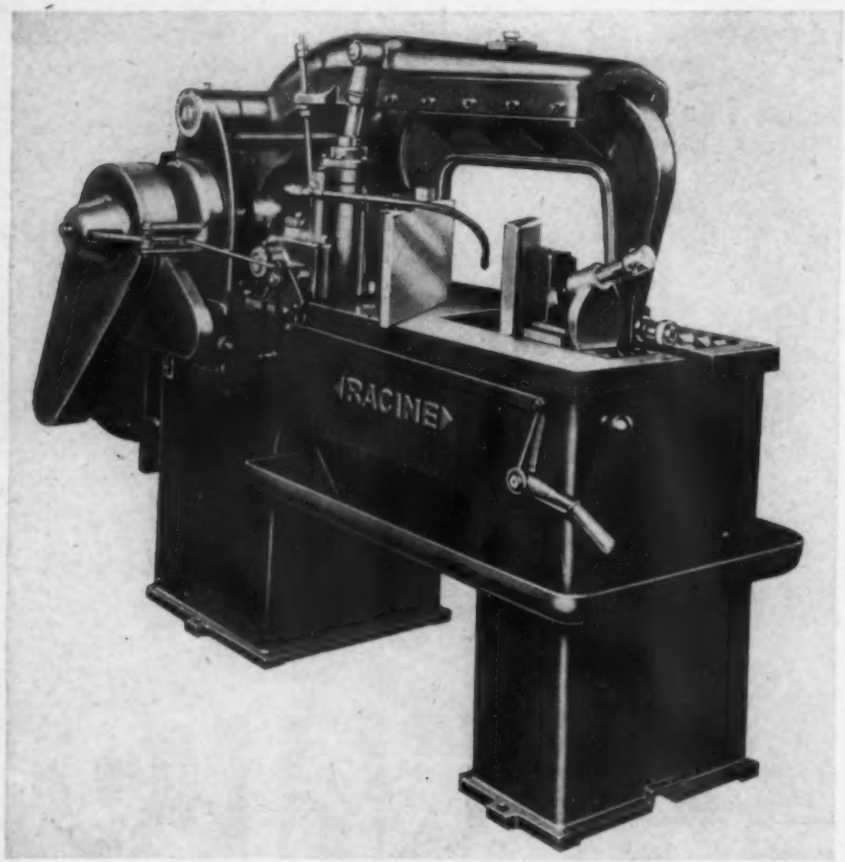


Circular Cutting on Lathes Offered by Milling Attachment

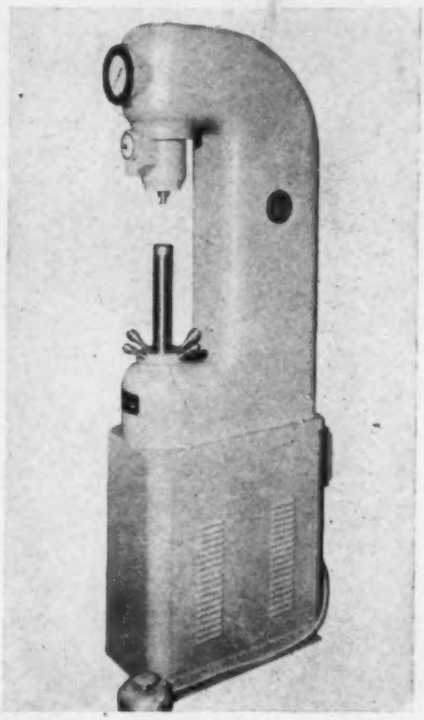
An indexing and milling attachment for milling operations on engine lathes is offered by Chicago Tool and Engineering Co., 8383 S. Chicago Ave., Chicago 17, Ill. Gears, splines, keyways, oil grooves, slots, square shafts, hexagons and flats on circular pieces can be cut. Work is held between centers or in collet chuck.

Model No. 300 will take work to 4 in. in dia. and 11½ in. between centers when 18-in. supporting bar is used. Attachment will fit lathes with toolposts up to 1¼-in. dia. Head and tailstocks are held by keys on supporting bar which has full-length keyway for horizontal movement.

A vertical feed travel of 1½ in. is provided by dovetail-type slide and fine screw adjustment. Chuck with ½-in. capacity collet, tailstock center and one 12-hole indexing plate and arm are furnished with No. 300 indexing attachment.



HYDRAULIC METAL-CUTTING saw for all types of metal in all sizes to 10x10 in., is announced by Racine Tool & Machine Co., Racine, Wis. An Oil-Cut model, the feed and pressure control, rapid traverse and lift on the non-cutting stroke are hydraulically operated. A push-pull lever permits gradual lowering of frame and blade for measuring cut-off lengths of stock

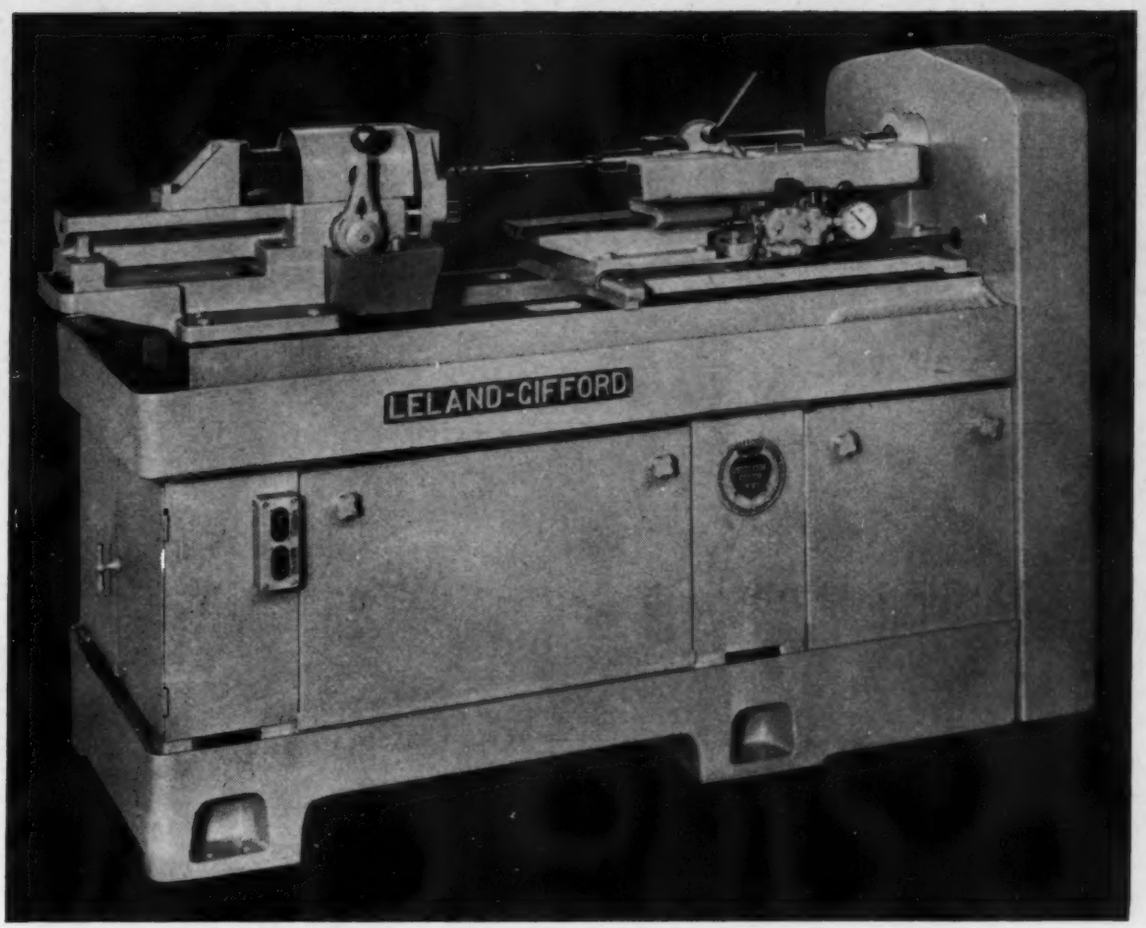


Brinell Hydraulic Testing Machine Checks up to 800 Pieces per hr.

A Brinell testing machine, Model KDR, capable of checking to 800 pieces per hr., is manufactured by Steel City Testing Machines, Inc., 8843 Livernois, Detroit 4, Mich. Parts varying to ¾ in. in diameter and thickness can be checked without moving the elevating screw.

The load is held for a pre-determined time cycle after which the penetrator automatically reverses itself to starting position for the next test. Machine is equipped with a comparator indicator. Throat opening is 6 in.; max. vertical opening is 14 in. Machine is motor-driven and hydraulically operated, and can be furnished with a foot- or knee-type starter switch.

NEW



HORIZONTAL step x step deep hole DRILLING MACHINE

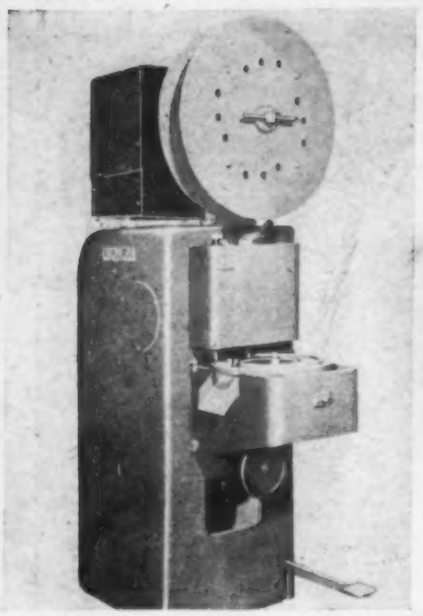
Now the same hydraulic step by step feed that has proved so satisfactory over a period of years for drilling deep holes vertically in shafts, rods, and forgings has been adapted to a horizontal drilling machine so that those pieces that are hard to mount vertically can be drilled by this method.

This horizontal hydraulic step by step deep hole drilling machine is built with either single or twin spindles, has individual Nema Motor, Vee Belt Drive to each spindle, built-in hydraulic pressure unit, traverses of 6", 10" or 14", and swing to suit your needs.

Let us talk over your deep hole drilling problem with you.

LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS, U. S. A.

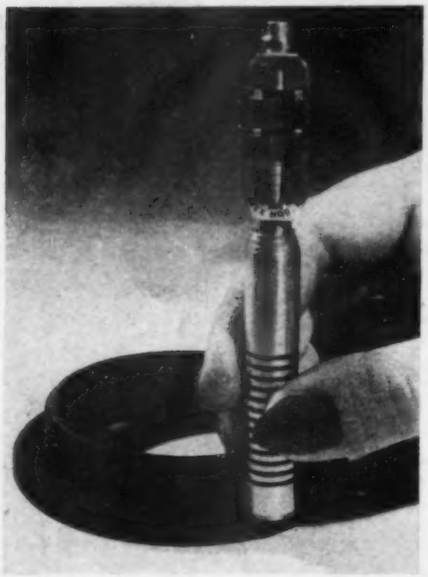


Automatic Butt Welder by Agnew Supplied with Table for Indexing

Agnew Electric Co., Milford, Mich., announces a special-purpose automatic butt welder with indexing table for welding nickel ground wire to spark-plug shells. Called Type SPB-2, it has synchronous control of welding current and time. Machine operates as long as foot pedal is depressed. Automatic cycle includes taking the wire from the reel, feeding to length, clamping, cutting-off, welding to shell and ejecting the finished part. Production is said to be 3600 pieces per hr.

Lift Truck by Lyon-Raymond Corp. Handles Skid Loads to 2500 lb.

A single-stroke lift truck for use with skid loads to 2500 lb. is introduced by Lyon-Raymond Corp., 4438 Madison St., Greene, N. Y. Large 8-in. dia. frontwheels are supplied on all models. Unit offers a 180° operating radius, pushbutton action to engage the lifting device, as well as a safety lock on handle. Truck is available in a wide range of sizes for use with popular-size skid platforms.



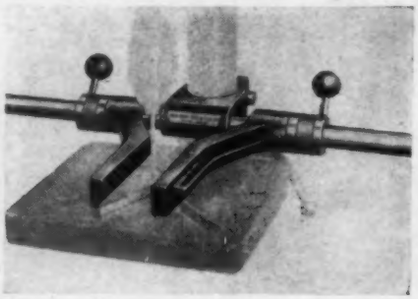
US Rubber's Rex Hardness Gage Contains No Gears, Cams, Levers

A device for measuring hardness of rubber and similar compounds known as the Rex hardness gage is marketed by United States Rubber Co., Rockefeller Center, N. Y. The gage, which is the size and shape of a large fountain pen, is operated when an indenter at one end is pressed firmly against the surface to be tested. Indicator is said to hold its position indefinitely so that exact readings are possible.

Instrument reads in the same units as the Shore durometer and meets the requirements of the latest rubber hardness test method issued by the American Society for Testing Materials. No gears, cams, levers or pivots are used.

Hydraulic Sheet-Feeding Tables Utilize Single-Speed Foot Pump

Two new models of the hydraulic sheet-feeding tables are offered by Lyon-Raymond Corp., 4434 Madison St., Greene, N. Y. Known as the 4000-lb. and 6000-lb. capacity tables, they are available in a synchronized dual-pedestal design. Standard base sizes are offered on which may be fastened tops of various widths. A 30° tilt top is optional. The single-speed hydraulic foot pump with 5 ft. of flexible hose enables the operator to increase the elevation from 24 in. to 36 in. without moving from the normal press-feeding position.



Safety Work-Holder by Universal Clamps to Column of Drill Press

Universal Vise & Tool Co., Parma, Mich., announces a safety work-holder which clamps to the column of any small standard drill press, and secures the work with a quarter-turn of a single lever. This tool is said to substitute for simple drill jigs in many cases. The clamping arms are adjustable along the length of the cross arm to encompass the full width of the drill-press table and can be swung back to clear a drill jig or machine vise when necessary.

Sangamo Type S Time Switch Powered by Low-Speed Motor

A compact time switch with overall dimensions of 3x5 ⅜x3 in. is offered by Sangamo Electric Co., Springfield, Ill. Called the Type S time switch, it is powered by a high torque, synchronous, self-starting, low-speed motor that is lubricated for life. Switch can be mounted on a standard switch box, or on a wall.

FOR ECONOMICAL PRECISION PARTS OF MACHINE TOOLS, JIGS AND MOLDS USE J&L COLD FINISHED FLATS

The size accuracy, surface finish and improved physical properties of Cold Finished flats make them applicable for many uses without extensive machining. They are economically made into slides for machine tools, parts for jigs and fixtures and molds for rubber and plastic. J&L Cold Finished flats are available in a variety of grades—in sizes from 6" to 15" from your nearest J&L Warehouse or distributor.

JONES & LAUGHLIN STEEL CORPORATION

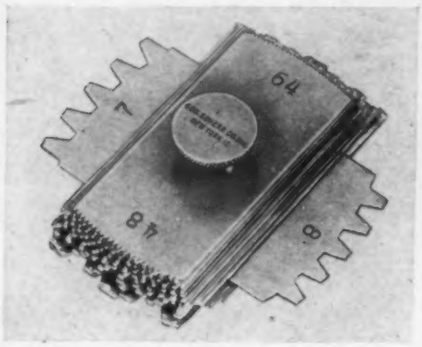
PITTSBURGH 30, PENNSYLVANIA

Metallizing Gun by Vande Mfg. Mixes Gases at Combustion Point

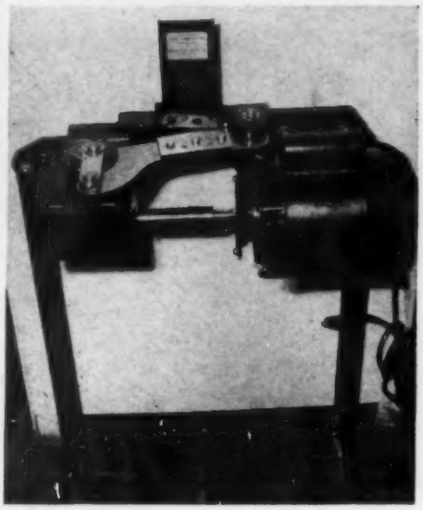
Vande Mfg. Co., 1837 S. Michigan Ave., Chicago 16, Ill., introduces a metallizing gun for application of steel, aluminum, zinc, lead, bronze and other metals. The gun is said to eliminate backfire. Its nozzle mixes the gas and oxygen at the point of combustion. Each wire nozzle is designed to provide exact volume for the gas used. No air cap adjustments are needed. Finger-tip turbine control is featured. It is achieved by a compound turbine containing a rotor and stator responsive to opposing propulsion fluids.

American Dispenser's Powdurn Employs No Mechanical Agitator

A dispenser for powder, beads, or pumice soap, called Powdurn, is offered by American Dispenser Co., Inc., 215 Fourth Ave., New York 3, N. Y. No ratchets, gears, or mechanical agitators are used. The container rocks back and forth shaking powder into the hand that operates the dispenser. Caking of powder is said to be avoided because moisture will not enter the container. Separate wall plate has a flat stainless steel spring. Capacity is one quart.

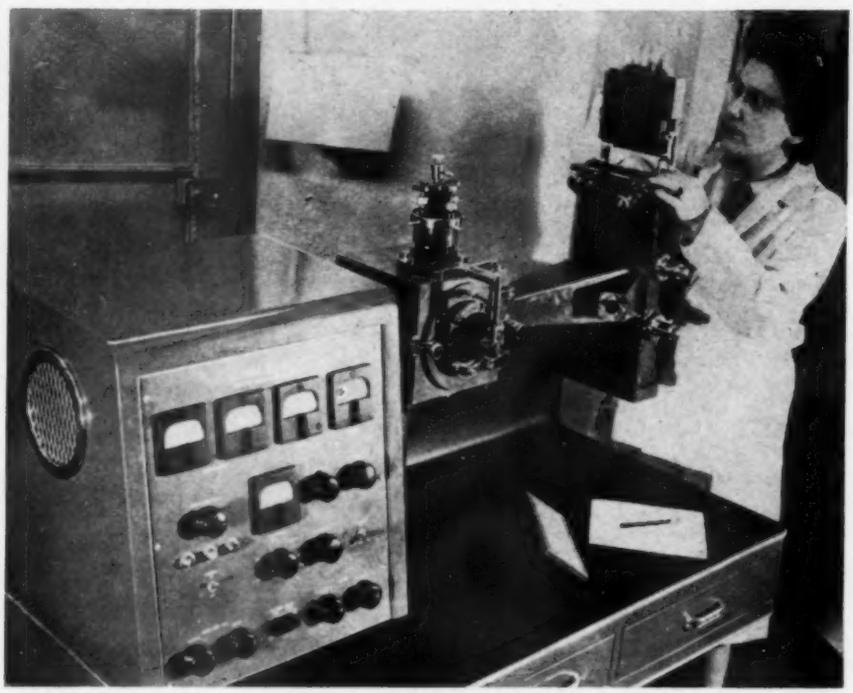


GEAR GAGE paper weight which serves as a paper weight combined with a set of gear gages made of stainless steel, is made by George Scherr Co., 200 Lafayette St., New York 12, N. Y. The set is composed of 12 leaves which include 24 varied gear shapes of different diametrical pitches. Teeth are of the correct involute shape.



Durant Automatic Scrap Chopper Sends Scrap Directly into Barrel

An automatic scrap chopper, which can be moved from press to press and will work in any position, is introduced by Durant Tool Supply Co., 155 Orange St., Providence, R. I. The scrap goes directly into a barrel without further handling. Maximum width of stock is 2½ in. Machine takes stock up to a thickness of 1/16 in.



RESEARCH tool, the electron diffraction instrument for studying surfaces and thin films is made by Special Products Div., General Electric Co., Schenectady 5, N. Y. It can be used in the observations and measurement of surface conditions of metals, ceramics and plastics, and in problems dealing with corrosion, catalysts, lubricants, metallurgy, pigments, surface deposits and graphite. Instrument shows crystal structure to 500 Angstrom units. Specimen chamber permits examinations of specimens ranging from 0.1- to 4-in. dia.

Why "M-11" produces

MORE TAPPED HOLES PER TAP

M-11 is a chrome-cobalt high speed steel used exclusively by Detroit Tap and Tool Company for taps, thread gages and thread milling cutters. Some of the reasons for its use are:

COBALT . . . **Takes the human element out of hardening. THIS MEANS THAT UNIFORM HEAT-TREAT CAN BE OBTAINED AUTOMATICALLY!**

Increases the red hardness over ordinary HSS. THIS MEANS M-11 TAPS ARE HARDER, TOUGHER AT OPERATING TEMPERATURES.

CHROMIUM . **Increases toughness and strength of steel after heat treatment. THIS MEANS LESS BREAKAGE.**

Causes hardness to penetrate deeper and more uniformly. THIS MEANS SAME QUALITY AFTER AS BEFORE SHARPENING.

Resists corrosion. PROTECTS TOOLS IN TOOL ROOM. ALLOWS GREATER LATITUDE IN COOLANTS.

Permits slower cooling after heat-treat. ELIMINATES NEED FOR QUENCHING WITH ITS CHANCE OF PRODUCING MINUTE HEAT CRACKS AND WARPAGE.

Provides greater resistance to abrasion. THIS MEANS MORE PIECES PER SHARPENING, MORE THREADS PER TAP.

This combination of chromium and cobalt in Detroit Tap's M-11 high-speed steel is available to you at no increase in cost over quality taps made of ordinary high-speed steels. And back of every M-11 tap, thread gage and thread milling cutter is Detroit's SERVICE — a service which can make the proud claim:

WE'VE NEVER "SHUT DOWN" A LINE YET!!

The Home of
"M-11"
CHROME-COBALT HSS TAPS, THREAD MILLING CUTTERS & THREAD GAGES

DETROIT
TAP & TOOL CO.
8432 BUTLER STREET • DETROIT 11, U. S. A.

Parts and Materials

Flagg-Flow Threadless Fittings For Brazing to Iron, Steel Pipe

Flagg-Flow threadless malleable pipe fittings made for brazed pipe joints are manufactured by Stanley G. Flagg & Co., 1421 Chestnut St., Philadelphia 2, Pa. Flagg-Flow enables the use of plain-end pipe, thereby eliminating thread cutting which would weaken the pipe wall by reducing its thickness.

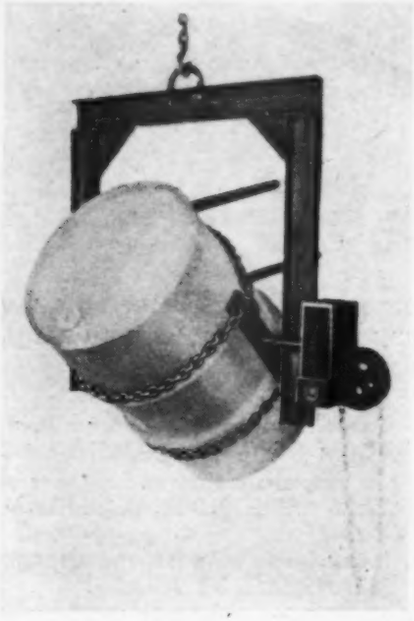
Designed for brazing to standard black-steel or wrough-iron pipe, the fittings are made in sizes to 2 in. It is said to give to iron and steel pipe the advantages of low-friction loss found in welded pipe. Joints are made with silver brazing alloys.

Specialty Steel by Amalgamated Offered in Various Shapes, Sizes

Tool-room specialty steel is introduced by Amalgamated Steel Corp., Newburgh Mill District, Cleveland 5, Ohio. T.R.S. steel can be quenched in oil, water, or salt bath, giving almost any degree of hardness. It is claimed not to crack in heat treatment, and is said to weld readily. The steel is available in flats, rounds, squares, hexagons, octagons, and billets in various sizes, and is said to have toughness and strength.

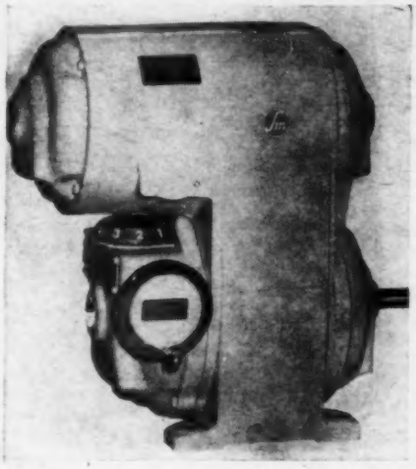
Expanded Line by Sulflo, Inc. Offers Penetrating Oil, Fluxes

The addition of plumbing, steamfitting and metal-working specialties is announced by Sulflo, Inc., 1143 E. Jersey St., Elizabeth 4, N. J. The expanded line is to be known as the Sulflo Quality Line and includes solder fluxes, pipe-joint compounds, penetrating oil, layout liquid, and a new all-purpose cutting compound.



Palmer-Shile Drum, Barrel Tilt Equipped with Locking Devices

A drum and barrel tilt is introduced by the Palmer-Shile Co., 16019 Fullerton Ave., Detroit 27, Mich. Designed for simplification of materials handling and the elimination of hand dumping, it can be used for controlled dumping of chemicals, liquids, plastics, molding powder and other materials. Unit is equipped with two safety-type locking devices that hold barrel securely without slippage. Barrel can be turned 360 degrees. Turning mechanism incorporates the worm drive principle. Capacity of unit illustrated is 1000 lb. for standard 55-gallon drum or barrel.



VARIABLE-SPEED electric power drive, the Speed-Trol, is made by Sterling Electric Motors, Inc., 5401 Anaheim-Telegraph Rd., Los Angeles 22, Calif. Unit provides fingertip speed control throughout its entire speed range, combines motor and speed control in one unit, and fits standardized NEMA motor mountings

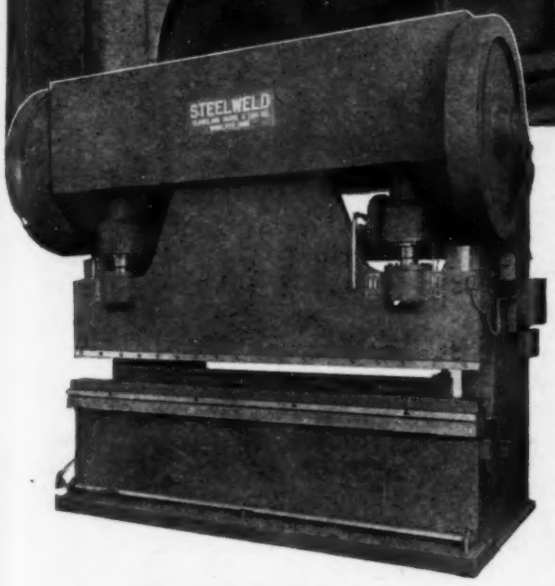
Wrap-Rax Insulating Tape Heated to Insure Adhesion

An improved Wrap-Rax masking and stop-off tape with thermal and chemical resistance designed for increased ease of handling is marketed by Hanson-Van Winkle-Munning Co., Matawan, N. J. The tape is heated after application to 300-325 F. to insure adhesion at each lap of the winding. Wrap-Rax can be used without fluxing under less severe conditions. When used in this way the final lap should be cemented as well as tied down to insure retention of tension.

Packaging Program for Veelos

An improved packaging program for Veelos, the link V-belt, is being used by Manheim Mfg. & Belting Co., Manheim, Pa. Each reel of Veelos is now available in an individual carton which shows the size and type V-belt, assuring untampered reels.

Flanging the edges of three stoker panels at a time.



NEATLY ROUNDED FLANGES
Just another simple job on STEELWELDS

Did you ever have a problem in metal forming? Did you ever wonder how to make some unusual shape — and do it at the least possible cost? Many Steelweld customers have been confronted with such situations. Very often they have discovered the solution to be in their Steelweld press right in their own shop.

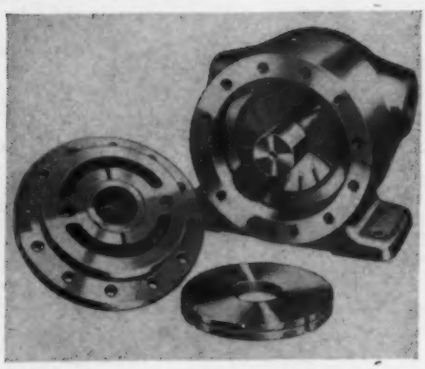
A stoker manufacturer had a problem on how to flange the edges of stoker panels. They had to be round and neat on three sides. He found the answer in his Steelweld. Now he flanges the edges of three panels per ram stroke quickly and accurately.

The varied work and the simplicity with which it can be done, makes a Steelweld press an unusually versatile tool that is appreciated more and more as its possibilities are discovered with actual experience. Write for booklet below and get the details.

GET THIS BOOK!
CATALOG No. 2002 gives complete construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
1401 EAST 282nd ST. WICKLIFFE, OHIO

CLEVELAND
STEELWELD PRESSES
BENDING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING



Rotor Ring on Vane-Type Pump Controls Volumetric Output

An adjustable-volume vane-type oil hydraulic pump for use in limited space is offered by Racine Tool & Machine Co., Hydraulic Div., Racine, Wis. Called Model J, the unit can be installed in an area as small as 6x6 in. A volumetric efficiency of 90% is said to be maintained at 1000-lb. pressure.

The mechanical movement of the rotor ring controls the volumetric output. The self-lubricated pump is available with foot or flange mountings.

Rossaul Copper-Brite Solution Removes Oxides, Is Non-Fuming

A solution for bright dipping of copper and copper alloys called Copper-Brite is marketed by Rossaul Co., 119 W. 63rd St., New York 23, N. Y. Solution removes oxides and is said to leave metal bright, resistant to future tarnish or discoloration, and not to discolor silver solder. Metal is left passivated and ready for next operation.

Copper-Brite is said to be nontoxic, non-fuming and safe for the worker to handle. It can be used at room temperature in acid-resistant still tanks. Five seconds are required for a bright dip; three minutes for removal of heat scale.

Compar, Material by Resistoflex Unaffected by Organic Solvents

A material unaffected by fuels, oils and other organic solvents is introduced by Resistoflex Corp., Belleville, N. J. Called Compar, it is light in weight, possesses a high tensile strength, and is said to be nonsmearing, and to have a high resistance to wear and abrasion. It is used in low- and medium-pressure fuel, lubricating and hydraulic systems.

Peelcote Vinyl-Based Coating Peels Off, Is Chemically Inert

Watson-Standard Co., 225 Galveston Ave., Pittsburgh 12, Pa., announces a protective coating for metal parts which can be peeled off after it has served its purpose. Called Peelcote, it is an air-drying coating that can be applied by spray or dip methods and is said to dry quickly.

Peelcote is a vinyl-based coating and is said to have complete chemical inertness. It is available in clear transparent or solid hiding black.

GE Adhesive for Silicone Rubber Bonds to Ceramics, Glass, Metals

An adhesive designed for bonding silicon rubber to itself and to glass, metals, and ceramics is introduced by General Electric Chemical Dept., Pittsfield, Mass.

Known as GE adhesive No. 12509, it is said to remain flexible and resilient over temperatures ranging from —70 F. to 520 F., and to withstand continuous temperatures of 300 to 350 F. in a dry air circulating oven. It can also be used to bond glass to glass, glass to metals, and metals to metals.

Metco Sprabond Metallizing Spray Eliminates Surface Preparation

Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y., announces a metal which can be sprayed directly on to smooth, or highly polished steel and other materials without surface preparation.

Called Metco Sprabond, three steps are claimed to be required in building up a worn shaft with metallizing, as compared with eight steps previously.

Diamond G Aluminum Washer Incorporates Spring Lock

An aluminum spring-lock washer designed for use in all types of light-metal assemblies, has been developed by George K. Garrett Co., 1421 Chestnut St., Philadelphia, Pa.

Called the Diamond G aluminum spring-lock washer, it is said to have the strength and spring tension of a bronze or stainless washer. The corrosion-resistant washer is available in standard and special sizes as required.

Transparent, Oxide Coating Protects Aluminum Surfaces

The Technical Processes Div., Colonial Alloys Co., Philadelphia 29, Pa., announces the Anonizing process, an immersion method of protecting aluminum surface and maintaining its natural color.

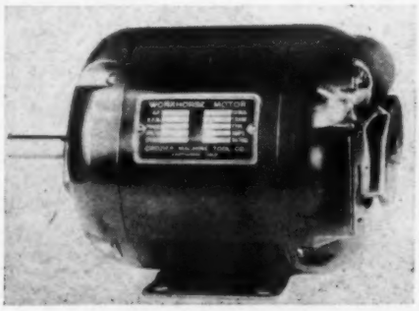
The transparent, oxide coating resembles a clear glaze, though not brittle. On some alloys, as those containing substantial amounts of silicon, the surface of the metal darkens slightly.

Coatings are said to have good abrasion resistance and are resistant to smudging, oxidizing, finger-marks, ordinary handling and high temperatures. Process consists of immersing the cleaned aluminum into the hot solution, then rinsing. Coating can be used as a base for paint.

Silver-Chip Grinding Coolant Handles Steel, Copper, Brass

A universal grinding coolant, the Silver-Chip No. 2 precision grinding compound manufactured by Machinery Lubricants, Inc., 31 St. James Ave., Boston 16, Mass., is designed to handle steel, copper, aluminum, brass and cast iron. Coolant is said to eliminate rust, reduce wheel dressing and to produce rapid chip settling. It is a non-foaming translucent solution.

CORRECTION: The heavy-duty lathe, with feed releasing box attachment made by Skoda Works, Czechoslovakia, and distributed by Industrial Operations, Inc., 381 Fourth Ave., New York 16, N. Y., (*AM*—Jan. 15, 1948, page 150) should have read ±0.0008 in. in length and ±0.0004 in. in diameter, as to tolerances maintained. These two dimensions were given in mm. by error. All other dimensions are correctly given in mm.



Crozier 29-lb. Electric Motor Employs Aluminum Squirrel Cage

A heavy-duty motor, single phase, ½ hp., is offered by Crozier Machine Tool Co., Hawthorne, Calif. Due to its low slippage, 2 pole develops 3,520 rpm., while 4 pole develops 1,760 rpm. Called the Workhorse, it weighs 29 lb., and has a cast-aluminum squirrel cage.

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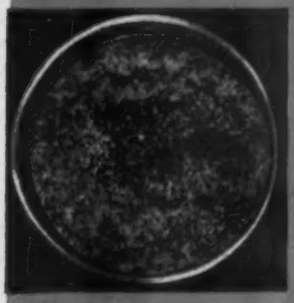

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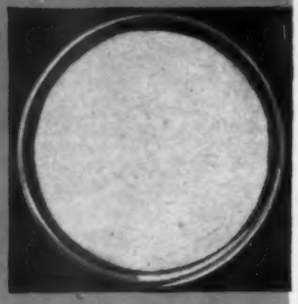

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In the machine tool industry the Dowicides greatly extend the useful life of cutting, grinding, rolling and hydraulic soluble oil emulsions —all of which are highly vulnerable to microorganism attack. Because the Dowicides are available in both oil- and water-soluble types, they are ideally suited to incorporation with these oils and emulsions to protect their effectiveness as lubricants and coolants. In keeping emulsions fresh by controlling bacteria and fungi, the Dowicides have proved their efficiency and economy. There are substantial dollar savings in preserving soluble oils.

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CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

ROUND TABLE *Discussion*

ARE TOOLMAKERS OBSOLESCENT?

Al is right when he says that in the modern large toolroom there is a tendency toward specialization: one man is a full-time miller, another spends all his time on grinding, and so on. On the other hand, there still is, and probably always will be, necessity and scope for the all-round man of wide experience.

Ed puts his finger upon a vital point when he says that journeyman planning and know-how can't be put in the machine. An example is the electrician who was sent for by a householder to repair an electric bell and finding a small connection broken replaced it and charged $5. In response to the householder's inquiry regarding the charge, he sent in a detailed bill thus: Supplying and fitting new connection $0.25; knowing how, $4.75.

Know-how is of the greatest value; someone must have it if a toolroom is to function at all and in any normal toolroom there is, and will continue to be, ample room for the all-around skilled journeyman. In any but the very largest toolrooms the place for the know-how is in the toolroom itself, not in the planning office.

Know-how can best be obtained by long and varied practical experience, and while colleges and technical institutions can undoubtedly contribute enormously, it seems fairly obvious that they can never be a complete and satisfactory substitute for experience gained under commercial conditions.

On the experimental and development side, there will always be ample scope for the good journeyman, and in this sphere he is, and is likely always to be, quite indispensable.

Summing up, Al is right about the tendency towards specialization in the toolroom, but Ed is right in believing that this cannot be carried too far. Ed is right too, at any rate so far as England is concerned, about the marked revival in apprenticeship; not only is there this marked revival, but much thought and time is being devoted to developing plans and methods of training which will insure the apprentice deriving the maximum of benefit from his training. This is one of the most heartening indi-

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STAINLESS STEEL—A SPECIAL FILING PROBLEM. Stainless steels, now widespread in modern industry, are a group of alloy steels with a very high chromium content. The most common type of stainless steel (known as "18-8"), for example, contains approximately 18% chromium and 8% nickel. This makes it tough and dense, and causes an abrasive action that tends rapidly to wear out the teeth or edges of all cutting tools.

While regular purpose files will cut stainless steel, it is important to find files that will not only do the work *well* but also retain their cutting ability longer against the abrasive action of this dense steel.

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SPECIALLY DESIGNED FILE TEETH. Nicholson has perfected a special type of file tooth which has much longer life when used on stainless steel than regular file teeth.

HOW TO FILE STAINLESS STEEL. Stainless steels should be filed with a light pressure and a slow, steady stroke to prevent heating the metal—for it becomes harder as it becomes heated. This makes filing more difficult, and also causes the file's teeth to wear out faster. It is also important to "keep the file cutting," otherwise the surface of the metal becomes glazed and therefore more difficult to file.

FILING STAINLESS STEEL

Nicholson and Black Diamond Files for stainless steel are made for fast stock removal on thick sections and for smooth filing on narrow sections. They are stamped "For Stainless Steel" and are available in the same shapes, sizes and cuts as regular purpose files. Available through industrial supply houses.

Nicholson makes special-purpose files for Brass, Lead, Aluminum, Stainless Steel, Foundry Castings, Die Castings, Die Making, Lathe Filing, Curved and Shear Tooth Filing—and Swiss Pattern Files of all shapes and sizes.
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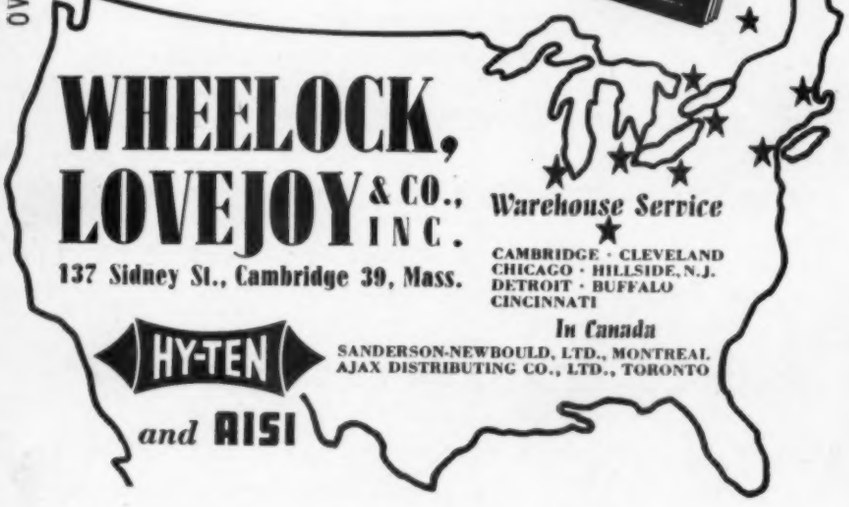

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cations, not only of a belief in our eventual return to prosperity, but of a determination to ensure it by providing adequate training for the skilled artisans and technicians of the future.

K. N. Harris
Harrow, England

•

TROUBLE SHOOTER OR TROUBLE MAKER?

It all depends on the type of man who is doing a job as to what detailed instructions the foreman should give. There are lots of shops where repetitious parts are made, so a foreman only need worry about giving instructions to a new man. His main job is meeting a production quota.

In a large job shop, or a shipyard, or a big gun shop, where each piece of work is really valuable, where quantities are often 2 to 10 pieces, and no two jobs are alike, although it is unnecessary to go into minute detailed instruction on each job to every man, a foreman has to know his men and act accordingly.

A new man in a large plant was put on an important job about a week after he started in the plant. There were six different operations on the job. After the new man had gotten started, the assistant foreman noticed that he was starting to do the third operation first. He spoke of this to the worker who replied, "Boss, if you will let me handle this job in my own way, it will be okay when finished." The foreman informed the superintendent, who asked if the new man seemed to know what he was doing, and upon being informed that it appeared as if he did, he said "Then take a chance and let him go ahead."

The new man did a fine job and in less than two-thirds of the time it used to take by using the regular method. It was discovered that he had been employed for a number of years in a plant whose products were almost identical with those in the new plant.

If that foreman had not had an open mind, this job might have been incorrectly operated for years.

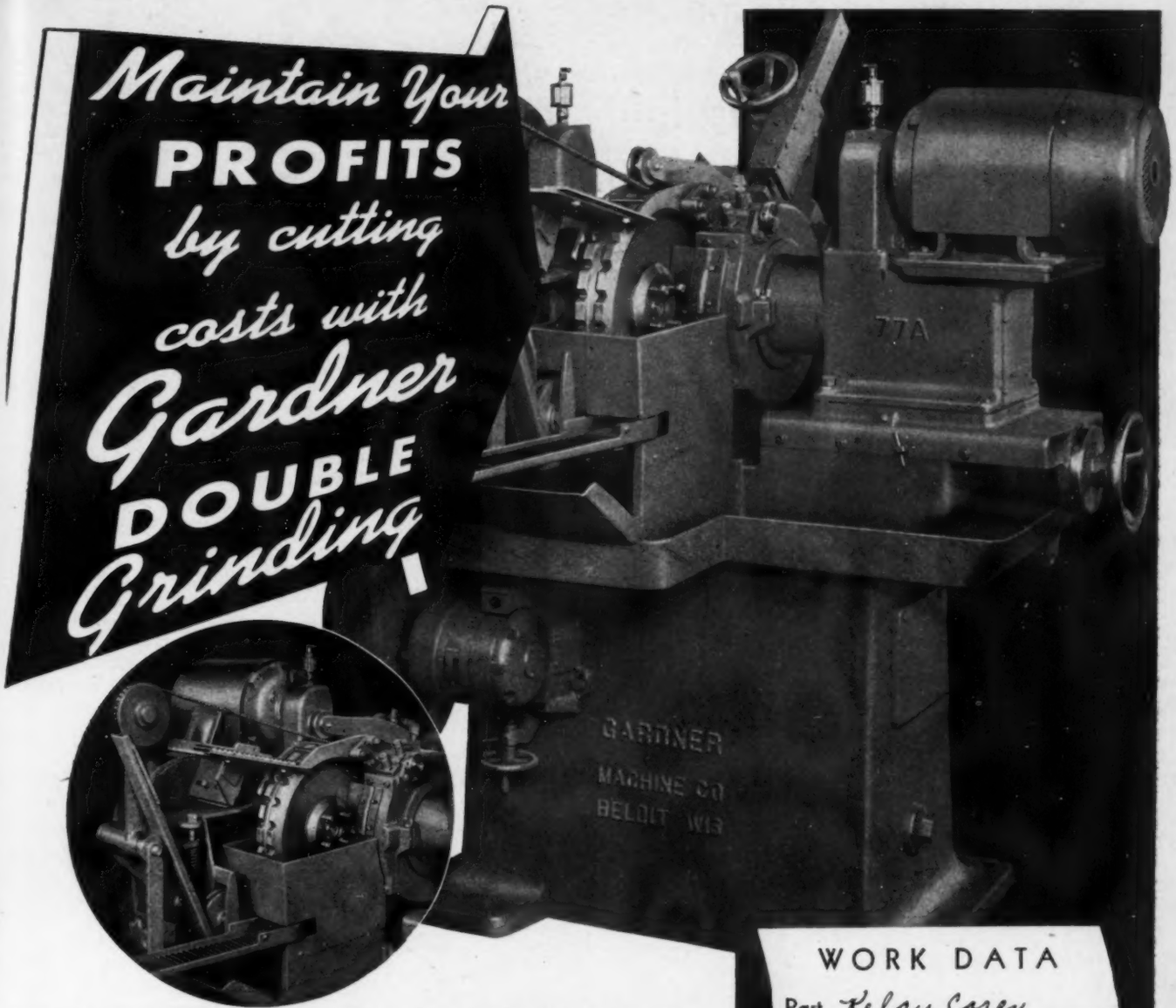
Arthur Silvester
Niantic, Conn.

•

CODDLE OR CULL?

Ed states that "the same ones are sick every week." This indicates that he has too many "repeater" absentees. The foreman may have to make plain that attendance records are unsatisfactory and that if prompt improvement is not shown, the next

Maintain Your PROFITS *by cutting costs with Gardner* DOUBLE *Grinding*



Cutting costs, **with GARDNER *Double* GRINDING is helping many manufacturers *maintain profits* — in spite of rising wages and increasing material prices. Reducing the time required to load and unload small parts, while holding work within essentially close tolerances, is one way GARDNER-GRINDING helps you avoid wasting manpower, or materials.**

In the photographs above, relay cores are being gravity-fed in a continuous operation, between the opposed wheels of a Gardner No. 77A-12" Grinder that grinds TWO ends at ONE time, and unloads the parts automatically.

You can protect your profits with FAST, ACCURATE, low-cost, PRODUCTION, by GARDNER-GRINDING your flat surface work!

WORK DATA

Part *Relay Cores*
Material *Cold Drawn Magnet Iron*
Operation *Grind Two Ends*
Tolerances *.001" to .0015" for Uniformity*
Stock Removal *.010" to .015" maximum overall*
Production *25 to 30 pieces per minute*
Feed *Hand Load to Gravity Trough; Automatic Unload*
Machine *Gardner No. 77A-12" Double Grinder*

Write for Latest Bulletin on Gardner DOUBLE Grinding!

GARDNER - GRIND YOUR *Flat* SURFACES

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For Round and Straight Bores Uniformly Sized and Finished

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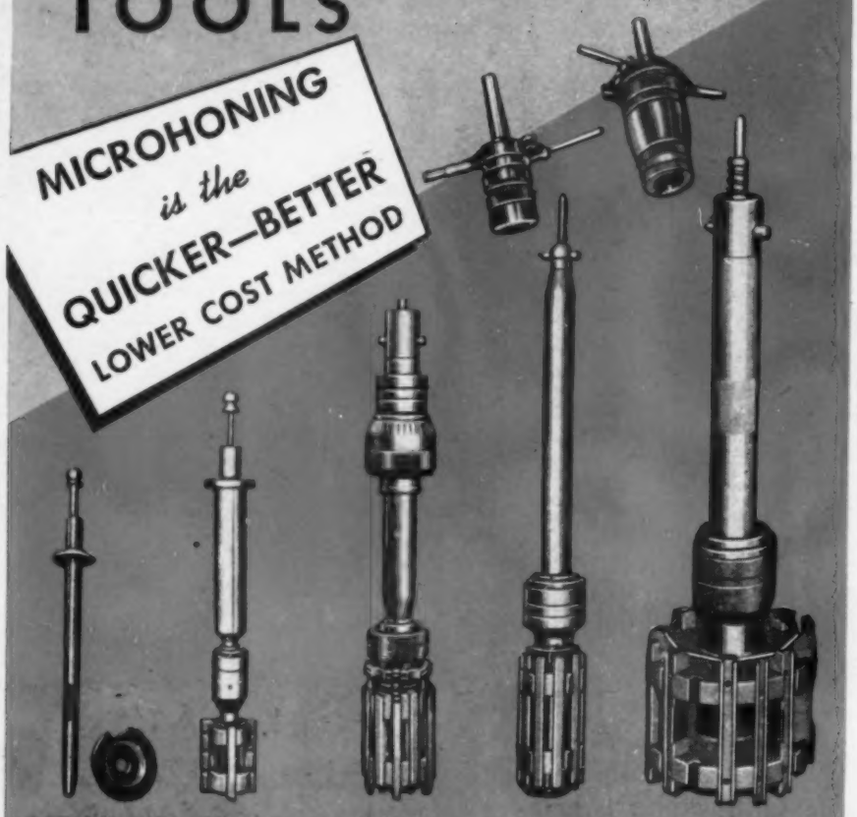
MICROHONING *is the* QUICKER—BETTER LOWER COST METHOD



Micromold* Tool and Microsize* Ring | General Purpose Microhoning Tools | Hydraulic Tools | Brake-Type Tools and Adjusting Head | Hydrobrake* Tools with Adjusting Head

MICROMATIC* MICROHONING TOOLS

in the range of bore diameter sizes from ¼" to 42", and up to 75 feet long, correct error and generate final roundness and straightness within limits of .0001" to .0003", either by AUTOMATIC or operator control—remove up to .080" stock at rates up to .012" per minute on diameter—and any desired type of surface finish. They are designed and constructed to meet the needs of economical precision production. We can mail further information.

*Trademark Reg. U.S. Patent Office.

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offense may bring decisive action.

Absenteeism is not, as Al believes, an outcome of World War II. It has long been a headache to foremen and is always worse in good times when jobs are plentiful.

As a corrective measure, the employment office or the foreman may hand the new employee a brief instruction sheet outlining shop requirements and stressing that repeated absences or tardiness will not be tolerated.

Every absence should be a matter of record. Upon the absentee's return to work, it should be investigated, and suspension for a day enforced for clear violations held inexcusable, and for a second offense, a week. When violations are found to be intentional and willful, dismissal is the only recourse.

Dismissing an employee is a serious matter, not to be done in haste. It is better to suspend a man for a month and suggest to him that if dissatisfied, he seeks employment elsewhere. A few bad apples will soon spoil a bushel. Cull the bad ones if necessary.

As to the problem of floaters, they are more likely to leave the employer than the resident worker. But, as floater mechanics are becoming scarce, they now are a minor problem. The good ones are intelligent men and not hard to control.

Setting up hard and fast rules for punishment of violations of shop rules had best be avoided. Each case deserves separate consideration lest some honest and faithful worker be punished the same as the chronic and willful offender.

F. M. A'Hearn
Greenville, Pa.

•

Because all personalities vary to some degree, both coddling and culling will be found necessary. First to be considered is the individual to be coddled or culled. His personal characteristics must all be considered. The type of work, and the conditions under which the man works, are important. The demand of industry for the class of work involved, as well as the personnel available for doing the work, is also a feature not to be overlooked.

Should the person prove to be a floater of long standing, yet normally content with his job, there is little to do. However, in some cases, a new type of work may prove of sufficient interest to the worker that he will enjoy steady work. If this procedure has been tried without good results, it may be well to keep the man on less-important jobs where a break in production will not

At the production rate of three pieces per minute, the S. K. Wellman Company of Cleveland, Ohio, is performing grooving operations on powdered metal aircraft parts approximately four times faster than ever before. This has been achieved by incorporating several automatic devices with a standard Walker-Turner Radial Cut-Off Machine to convert it into an automatic-radial grooving machine.

For this grooving operation the Radial Cut-Off Machine is equipped with a diamond impregnated metal wheel to do the cutting, and a magnetic chuck for work holding. The sliding head is motivated by an air cylinder with provisions for metering the feed. With this set-up extremely accurate work is done—the depth of each groove held within .003", and the accuracy of the index within .005".

In addition to increased production, Walker-Turner Machine Tools have given the S. K. Wellman Company continued operation with trouble-free maintenance. Says Mr. S. E. Truesdell of the company's engineering department: "Three Walker-Turner machines have been in our possession about five years, and in that period a very minimum, if any, maintenance has been required. We find these machines ... *are highly adaptable to intricate machining jobs with minimum set-up time*."

For complete catalog, write to Walker-Turner Company, Inc., Plainfield, New Jersey.

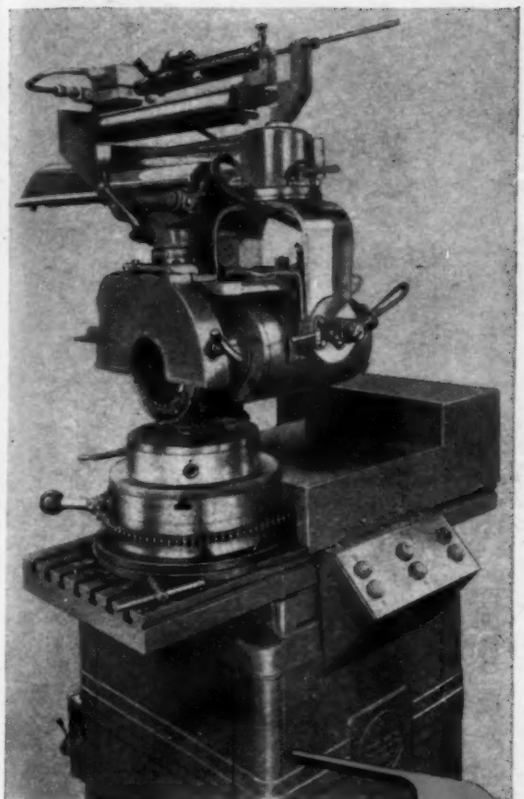
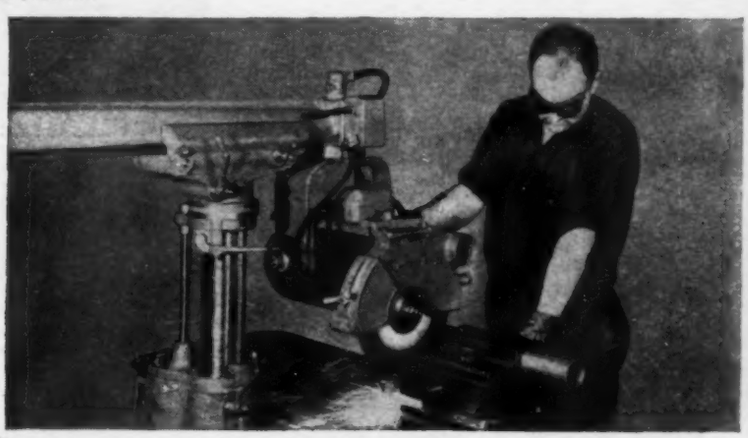


Photo left: Radial Cut-Off Machine in S. K. Wellman set-up for radial grooving with magnetic chuck and diamond wheel. Indexes automatically at the end of each ram traverse cycle.

Photo, below: Radial Cut-off Machine, Model MRA-1130, 3 h.p., 3450 r.p.m. motor. Price: Less abrasive wheel, magnetic overload release and base $485.00.



FOR EXAMPLE

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with WALKER-TURNER radial cut-off machine

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BEATTY Horizontal Hydraulic Bulldozer for heavy forming, flanging, bending.

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BEATTY CoPunShear, one unit does coping, punching, shearing.

cause serious delays in other departments. Additional care in hiring men for various jobs will lessen the problems encountered by the shop when having such floaters on the payroll. A thorough checking of recommendations and former places of employment will do a great deal towards keeping out such individuals. Under present-day conditions, with the demand on labor what it is, the employment manager can't always be in a position to select a steady worker. Until the supply meets the demand, these conditions are bound to exist and the floater will continue to get a break.

A recent case of 'coddling' which I witnessed has made a steady worker of one who had been consistently absent one or two days almost every week. One of the older toolmakers in a small tool shop evidently had found that he could make a living in three or four days a week. He was apparently content with his work, but, for no apparent reason, would take a day or two off. On questioning him, it was learned that he had been a foreman at one time. His tone of voice and his expressions of pride in his work were sufficient to convey the fact that he rather liked the idea of having a hand in the jobs the other men were doing.

During a month's illness of the regular foreman, this toolmaker was appointed as temporary foreman. He never missed a day. He had more pride in his work and had a feeling that he had an important job to do, and if he wanted to keep it, he had to be there every day. Upon the return of the regular foreman, he resumed his regular work, and in addition, made it a point to know about all the jobs on hand and at the same time exercise a partial supervision of the department. Several months passed and his attendance was perfect. This is only one case of many where a little 'coddling' makes a man enjoy working steadily.

Encouragement on the part of the foreman will pay fine dividends oftentimes. First tap the skull, then coddle or cull.

A. F. Scoblic
Milwaukee, Wis.

•

EXPERT OR EXECUTIVE?

Most executives have enough executive work to consume all of their time, and nothing in the regular line of work should interfere. However, unusual things are likely to happen occasionally that can be handled better and quicker by an executive to avert an emergency, and then the executive should not be too

"A real BOTTLENECK buster...

Flux-Injection certainly opens new fields for stainless design"

1 — The flanged periphery of the head.

2 — Adjacent inner ring, removed by Flux-Injection, cut into radial segments, and drilled, to form extractor plates.

3 — Bearing ring for rotor.

4 — Type 347 stainless vanes (Figs. 1 & 2) finish-cut by Flux-Injection and welded to nickel cladding.

5 — One-half of tub wall, separately fabricated of nickel-clad, in position for checking alignment and fit-up prior to shipping.

That's the stamp of approval placed on Airco's New Flux-Injection Method of cutting stainless, and nickel-clad steels by Smith & Caffrey Co., Syracuse, N. Y. and Dilts Machine Works (Division of Black-Clawson Co., Inc.) Fulton, N. Y.

Smith & Caffrey's problem was to manufacture a new all-welded design of the Dilts Hydrapulper, a paper making machine which reduces paper and pulp to slush form. Because of the abrasive and corrosive nature of the required mixture, the hydrapulper had to be fabricated from stainless and nickel-clad steels. Flux-Injection permitted the cutting of parts to finished dimensional accuracy, and with the utmost protection for the cladding. Resulting edges were in excellent condition for welding.

This new Flux-Injection Stainless steel cutting method was developed to enlarge the scope of standard Airco oxyacetylene cutting equipment. It keynotes simplicity, safety and economy of operation.

The factual article "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steels" gives further details. For your free copy of this interesting explanatory article, write to Dept. AM- 7288, Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas. Internationally represented by Airco Export Corporation.

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5-, 10-, 12-, 18-, 30-ton

No. 3-30 TON

SPECIFICATIONS	
Dia. of Crankshaft at Bearing and Pin	3"-4"
Standard Stroke	2½"
Adjustment of Slide	1¾"
Dist. Bed to Slide, Stroke Down, Adj. Up	10"
Dist. Bolster to Slide, Stroke Down, Adj. Up	8"
Bolster Thickness	2"
Bolster Area	13¾" F.B. 22½" R.L.
Opening in Bed	7½"x10"
Dist. to Back from Center of Slide	7"
Opening in Back	11"
Area of Slide	7¾" F.B. 5¾" R.L.
Dia. of Hole in Slide for Die Shank	2"
Stroke per Minute	110
Motor Required	3 H.P., 1200 RPM
Shipping Wt. Less Motor, Approximately	3200 lbs.

Standard equipment includes bronze bushings throughout, knock-out bar in slide and semi-steel bolster plate, single stroke attachment and brake. Extra equipment available, longer stroke than standard, motor drive arrangement including belt guard.

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backward about getting his hands dirty.

The greatest asset that an executive can have is natural leadership, which can be acquired only to a certain extent. Square dealing always endures, however, and frequently offsets other deficiencies.

John Mark May
Watervliet, N. Y.

"Quotes"

Why Buy Materials-Handling Equipment

A. T. GAUDREAU, management engineer (Stevenson, Jordan & Harrison, Inc., New York), stressed possible manufacturing cost reductions at the 1947 Pittsburgh Mechanical Engineering Conference. Emphasizing that the materials-handling cost is the largest single item in total manufacturing labor and expense cost, he said:

"Materials-handling equipment is purchased for the dual purpose of reducing the cost of material-handling and of expediting the flow of material through the plant. In accelerating this flow, not only are transportation costs lowered, but inventories also are reduced in size, shipments are made more punctually, plant capacity is increased through better utilization of existing facilities, and product unit costs are reduced throughout the various processing operations by reason of the larger volume allowed to flow through production.

"In selecting methods of handling materials, and in reflecting these in plant-layout design, it is necessary to possess more than practical operating experience. There is always one best way permissible in a plant layout of transporting material between operations.

"This one best way can be obtained from a thorough knowledge of all existing methods and equipment, and not of but a few familiar ones. Adequate engineering rather than mere guessing is the only sound approach to a good layout.

"Progress in materials handling in many plants has been neglected or retarded largely from the lack of a

Precision **Rod Cutting** *at High Speed*

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DI-ACRO ROD PARTER

This newest member of the DI-ACRO "DIE-LESS DUPLICATING" family of Machines brings you accuracy, speed, capacity range and ease of operation fully up to the standards of DI-ACRO Benders, Brakes, Shears.

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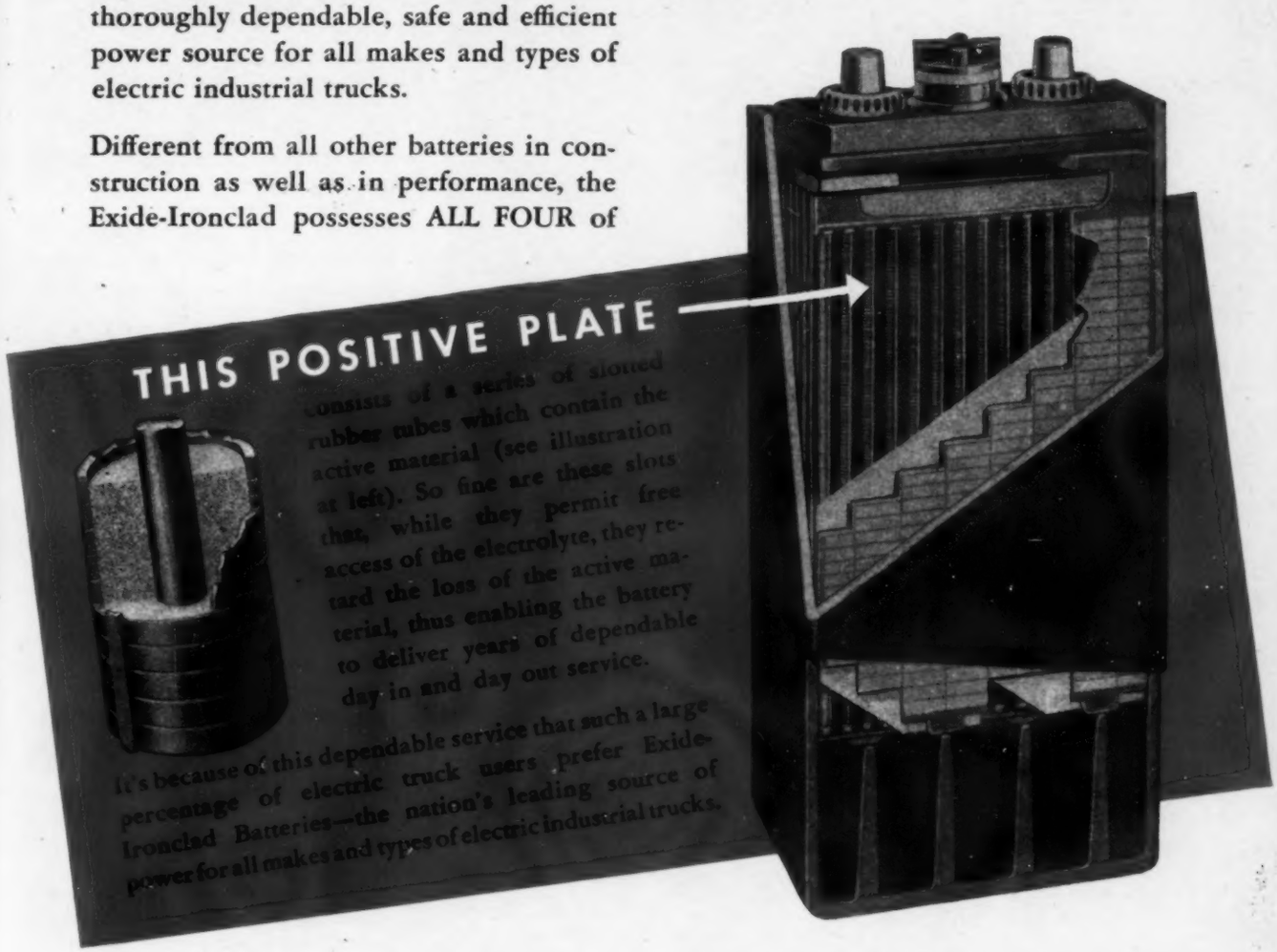
IN a recent national survey made by a leading industrial publication, 81.1% of electric industrial truck users expressed a preference for Exide-Ironclad Batteries.

Such overwhelming preference for the Exide-Ironclad Battery is based upon user experience. This unique battery has, during the past 35 years, proved itself to be a thoroughly dependable, safe and efficient power source for all makes and types of electric industrial trucks.

Different from all other batteries in construction as well as in performance, the Exide-Ironclad possesses ALL FOUR of the essential characteristics demanded of a battery for electric industrial truck service—(1) high power ability, (2) high efficiency, (3) great ruggedness, and (4) long life. These characteristics are due to the special construction of the Exide-Ironclad Battery, especially its rugged, tubular positive plate.


THIS POSITIVE PLATE
consists of a series of slotted rubber tubes which contain the active material (see illustration at left). So fine are these slots that, while they permit free access of the electrolyte, they retard the loss of the active material, thus enabling the battery to deliver years of dependable day in and day out service.
It's because of this dependable service that such a large percentage of electric truck users prefer Exide-Ironclad Batteries—the nation's leading source of power for all makes and types of electric industrial trucks.

Write for further particulars and FREE copy of Exide-Ironclad Topics, which covers latest developments in material handling and shows actual case histories.

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ROLLER conveyors are unequalled in low first cost, flexibility and minimum operating expense. They handle a wide range of commodities — parts, packages, units, cartons, cans, bottles, barrels, bundles, drums, boxes. They are available in light, average, or heavy-duty types for either portable or stationary use —in a wide variety of sizes, styles, sections and lengths. Roller conveyors are built in their entirety by Standard, including the vital bearings which are manufactured to the highest standards.

Besides roller, Standard builds belt, chain, slat, and push-bar conveyors, also spiral chutes, portable pilers and conveying units, and pneumatic tube systems.

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broad familiarity with the various materials-handling facilities being developed constantly in a progressive country such as ours. There has also been a lack of willingness in some cases to profit from the experience of other people.

"The fact that the total materials-handling cost remains unknown in most plants accounts largely for the lack of realization that materials handling offers the one remaining great opportunity for cost reduction within reach today. The possibilities of making a major reduction in manufacturing costs through revising existing plant layouts are yet virtually untouched in industries outside of meat-packing, automotive, chemical, food and certain foundries."

•

Cutting Indirect Costs

EZRA W. CLARK, at the Production Conference of the American Management Association (New York, Dec., 1947), emphasized the cost-cutting features of better materials-handling methods.

"Every skilled worker," he said, "carries on his shoulders the burden of unskilled labor. Let's analyze the deadlines of the superimposed load or "dead horse" that management forces its skilled workmen to carry. Nation-wide surveys of production industries show that 80% of unskilled labor used in the average plant is devoted to the lowly tasks of lifting, toting, carrying, pushing, placing materials that are processed or fabricated in, through, and from our mills and factories.

"If the skilled mechanic today carries on his shoulder one-tenth of an unskilled man at $1 an hr., he carries a handicap of 80c a day. This epitomizes my argument for the mechanization of materials handling and forces the conclusion that management must more and more implement the efficiency of its production techniques by converting its unskilled labor into semi-skilled labor by giving him power machines to move his loads.

"The old concept of production efficiency in general terms rated the production manager by the percentage of floor area effectively used in plant production. The modern concept requires evaluation in the percentage of cubic area of the plant effectively used in production.

"I know of one plant with a good production manager, but not good enough for the current times. Pressed for increased production, he requisitioned for plant additions.

BAKER

Versatile Model

3 x 12 HYDRAULIC FEED SADDLE UNIT...

With readily exchangeable Hydraulic Feed Power Unit outside the machine base.

The new Baker one to three H.P. hydraulic feed unit is readily adaptable to special machine application as either a primary or auxiliary unit. Units may be mounted in vertical, horizontal or angular position and are adaptable to single or multiple spindle operations. A completely separate mobile pump-sump unit mounted on casters provides hydraulic power for the Baker 3 x 12 unit through only two self-sealing couplings, designed to allow rapid exchange of power units whenever desirable. For more information write for Baker 3 x 12 circular No. 69946.

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McVoy-Hausman Co., Birmingham, Ala.

Motch & Merryweather Machinery Co., Cleveland—Detroit—Cincinnati—Pittsburgh

J. F. Owens Machinery Co., Syracuse, N. Y.

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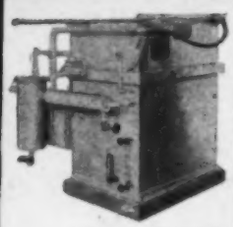
of METAL PARTS



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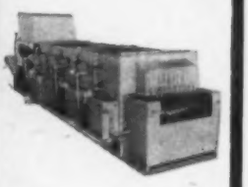

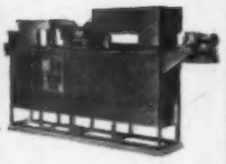

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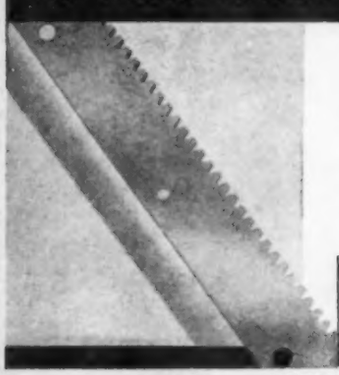

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Practically every square foot of the plant outside of aisle space was efficiently used, but the "air rights" above the production machinery, up to the roof girders, were wasted. Top management introduced modern materials-handling methods, thereby utilizing the "air rights" within the factory, and the *new* plant management was able to use the same space and yet multiply production ten-fold.

"When, through the introduction of modern materials-handling methods and equipment, the production was multiplied ten-fold, factory overhead was reduced with startling rapidity. The factors of space rental or evaluation, heat, janitor service, supervision, management and the countless scoundrels of cost that ride production for free but which add up to the non-productive costs, instead of being distributed over a few units, are now distributed over ten times as many units with a consequent cutting of the percentage factor as to each unit of production."

•

Sampling Plans

E. U. CONDON, Director of the National Bureau of Standards pointed out, at the 1947 Annual Conference of National Institute of Government Purchasing, that (1) purchasing requires the careful development of precise and detailed specifications of the material desired, (2) purchase specifications should include a section on test procedures and (3) purchase specifications should also contain specific sampling plans or refer to a standard set of plans.

"It is evident," he said, "that inspection and testing of samples cannot give exact information about the whole lot. But this does not mean that we have to content ourselves with fuzzy and vague descriptions of the results of an inspection procedure. This is a problem which can be dealt with by the mathematical theory of probabilities, with the same sort of definite results which apply to the life insurance business in spite of the unpredictability of the duration of the life of a particular individual.

"The function of the sampling plan is to lay down rules for the acceptance or rejection of lots of items, just as it is the function of the test-procedures section to lay down rules for deciding on the conformance or non-conformance of individual items.

"Every well-defined sampling plan can be treated mathematically and

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Whatever you pay : : : it's too much!

Because it is possible to eliminate entirely this time-taking, costly assembly operation with Tinnerman SPEED NUTS.

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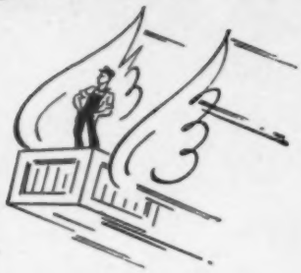
THERE'S A SPEED NUT FOR EVERY FASTENING NEED—MORE THAN 4000 SHAPES AND SIZES

Engineered to move materials with **SPEED SAFETY EFFICIENCY**



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CM overhead materials handling units are designed to increase plant output and lower production costs by mechanizing and speeding the movement of materials. If you are improving or expanding your plant, it will pay you to check up on CM industrial hoists. Three of the most popular units in the CM line are...

The CYCLONE Model M High speed heavy duty hand hoist. 96% efficient. 1 ton capacity weighs only 35 pounds. Sealed in lifetime lubrication. Capacities from ¼ ton up.

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The METEOR Fast, heavy duty electric hoist. Airplane type cooling. Push button control. Single or two speed. Capacities from ½ ton up.

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characterized by its operating characteristic (OC) curve. This is a curve in which the probability of acceptance of a lot is plotted against the actual fraction of non-conforming items (fraction defective) in the lot.

"The simplest approach would be to agree that all lots containing less than, say, 2% defective would be acceptable and those containing 2% or more defective would be rejected. Then we would want a sampling plan which would give us certainty of acceptance if the sample contained less than 2% defective and certainty of rejection if the sample contained more than 2% defective. But this can only be accomplished if we do a complete inspection of the entire lot.

O C Curve

"The OC curve for an actual sampling plan always departs from this ideal situation in two ways: (a) It will give some chance of rejection of lots whose fraction defective is less than 2%, or whatever figure was agreed on; (b) it will give some chance of acceptance of lots whose fraction defective is greater than 2%.

"The existence of property (a) represents an unfairness to the supplier in that it occasionally rejects good lots, while that of property (b) represents an unfairness to the user in that it sometimes accepts for him lots which should have been rejected. Both features can be reduced by doing more inspection at consequently greater cost. Our problem is to achieve the most economical and efficient compromise between these limitations of a sampling plan and the desire to minimize inspection costs.

Unsatisfactory Plans

"It is rather surprising how unsatisfactory some sampling plans can be. Consider for example an inspection plan in which a sample of two is drawn from a lot of 100 items. The lot is accepted if both items in the sample meet the requirements and rejected if either one fails. This plan . . . provides very poor protection against acceptance of lots containing very large amounts of defective goods.

"A better procedure would be to select a suitable type of sampling plan which has the desired operating characteristics for lots of given size. Such a plan would be applicable to a range of lot sizes. This fact makes it feasible to have a set of standard sampling inspection plans of various kinds that are usable for fairly wide ranges of lot sizes."

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SERVICE PACKAGING OF COATED ABRASIVES

Service Packaging brings to distributors, dealers and consumers a new convenience and economy in the buying, selling, handling and use of coated abrasives.

Completed after two and one-half years of research into the packaging requirements of our customers, it provides five improvements: standard master packages—standard component resale packages — decimal counts—brand recognition by colored labels, and line identification by wrapper design.

The complete story of Service Packaging is interestingly told in our attractive 24-page book, your copy of which is available on request.

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

Names in the News

Walter E. Remmers

Walter E. Remmers, vice president and director of Electro Metallurgical Co., since 1945, has been elected president of the firm as well as of Electro Metallurgical Co. of Canada, Ltd., and associated metallurgical units of Union Carbide and Carbon Corp.

G. W. Munger has been elected vice president in charge of purchasing for the Hudson Motor Co., Detroit. He succeeds **Charles A. Oostdyk,** who has resigned.

Walter S. Carpenter, Jr. has resigned as president of E. I. du Pont de Nemours & Co., Wilmington, Del., and been named chairman of the board. He is succeeded as president by **Crawford H. Greenewalt,** former vice president and director.

J. K. Sutherland has been appointed vice president in charge of sales of the Benchmaster Manufacturing Co., Los Angeles.

J. Robert Pauline has been appointed works manager for the Kellogg Div., American Brake Shoe Co., Rochester, N. Y.

H. Ward Zimmer, vice president in charge of the radio tube divison, has been named vice president in charge of manufacturing operations of Sylvania Electric Products, Inc., New York.

W. A. Roberts and **W. C. Johnson,** executive vice presidents, and **Hugh Comer,** have been elected to the board of directors of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Jack R. Lakin has been appointed general sales manager of the drop forge division at Willys-Overland Motors, Toledo, Ohio.

Russell G. Ford has been named general purchasing agent for the Chevrolet Motor Div., General Motors Corp., Detroit.

E. George Hartman has been named general sales manager of John A. Roebling's Sons Co., Trenton, N. J.

Dr. G. V. Slottman, formerly manager of the Technical Sales Div., Air Reduction Sales Co., New York, has been appointed technical assistant to the president. He is succeeded by **Scott D. Baumer.**

Jules Muller

Jules Muller has been appointed director of engineering of the E. W. Bliss Co., Detroit.

Arthur J. Wieland

Arthur J. Wieland has been elected to the newly-created position of executive vice president of Willys-Overland Motors, Toledo, Ohio. He has been vice president in charge of distribution since 1946.

Richard Kimball has succeeded **Samuel S. Diemer** as director of purchases at the Carborundum Co., Niagara Falls, N. Y. Mr. Diemer retired after 45 years with the firm.

Charles P. Collins

Charles P. Collins has been elected president and director of The Norma-Hoffman Bearings Corp., Stamford, Conn. He was formerly secretary and general counsel of SKF Industries, Philadelphia.

Richard H. Diesel has been appointed assistant general sales manager of the Stamford Div., The Yale & Towne Manufacturing Co.

Raymond J. Bryan has been named manager of the Buffalo Stainless Steel Foundry of the Allegheny-Ludlum Steel Corp., succeeding **Donald M. Scott.**

Dr. John A. Fellows has rejoined the American Brake Shoe Co. as asisstant chief metallurgist at the company's research center in Mahwah, N. J.

Thomas A. Nelson has been appointed director of research and engineering of Machinery Lubricants, Inc., Boston.

Louis S. Kimball has been appointed sales manager for Bell Aircraft Corporation's new materials handling device, the Prime Mover.

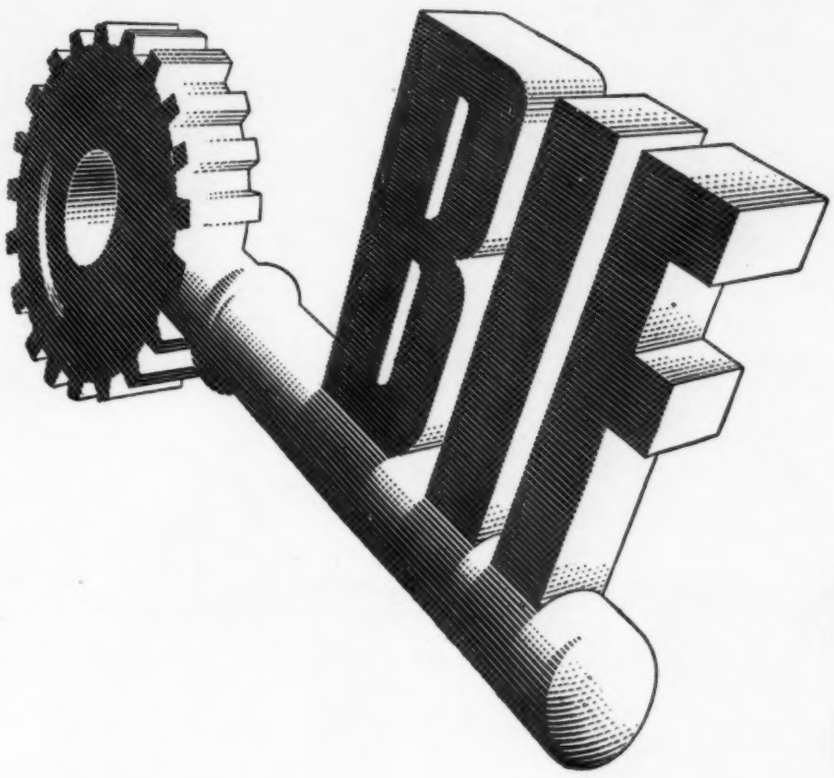
Emerson E. Case, vice president and general manager since 1940, has been elected president of the Robeson Cutlery Co., Perry, N. Y. **Milton M. Zelter** has been elected vice president in charge of sales.

Ray E. Hawkins has succeeded **James E. Burke** as general superintendent of the Barcalo Manufacturing Co., Buffalo.

L. B. Smith, vice president and director of the A. O. Smith Corp., Milwaukee, Wis., has been appointed general manager of the Kanakee Works of the firm.

LONDON *and* BIRMINGHAM

BRITISH INDUSTRIES FAIR



1948

MAY 3-14

ON May 3rd 1948, when the British Industries Fair opens, buyers from all over the world will have an opportunity of inspecting the products of 3,000 United Kingdom manufacturers.

This annual event is the world's largest national trade Fair. Such is its size and importance that you are urged to *come yourself.* You are assured of personal contact with actual manufacturers or sole selling agents and you will find exhibits carefully grouped by trades so that comparisons may be made quickly. Above all you will see new achievements, new methods of manufacture and new ideas all executed with superb craftsmanship.

This is your only opportunity in 1948 to review within a few days the achievements of 87 United Kingdom industries.

For information and assistance you should apply to the nearest British Embassy, Legation or Consulate.

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HASSALL cold-heading may solve your immediate special part problem . . . Special nails, rivets and threaded parts made in diameters from 1/32" to 3/8"—lengths up to 6" . . . Rivets 3/32" diameter and smaller a specialty . . . Variety of metals, finishes and secondary operations . . . Economy, quality and quick delivery in large or small quantities . . . Tell us what you need . . . We will answer promptly. ASK FOR FREE CATALOG. 3-color Decimal Equivalents Wall Chart free on request.

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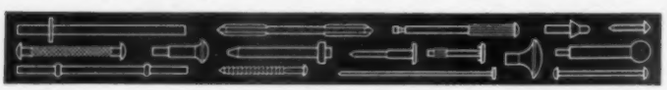
Manufacturers of Cold-Headed Specialties—Established 1850



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Here's a TOOL KIT that will save you a lot of TIME and MONEY

With this ***MINUTE MAN*** kit you can cut keyways ***IN ONE MINUTE***

in ***GEARS*** ***COLLARS*** ***CUTTERS*** ***PULLEY HUBS*** ***COUPLINGS*** ***etc., etc.***

Kit contains everything you need to cut complete range of keyway sizes—precision hand broaches, slotted bushings, shims, keyway stock. Used with du Mont or other Arbor Press. Cut a few keyways and you've paid for the Kit.

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Get the whole story on what this Kit does, how it works, how little it costs.

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Please send me Descriptive Folder and Price List "A"
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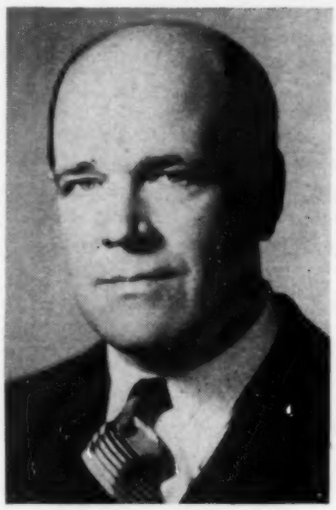
NAMES IN THE NEWS



John E. Martin

John E. Martin, formerly vice president and director of American Type Founders, Inc., has been named president of The Firestone Steel Products Co., Akron, Ohio.

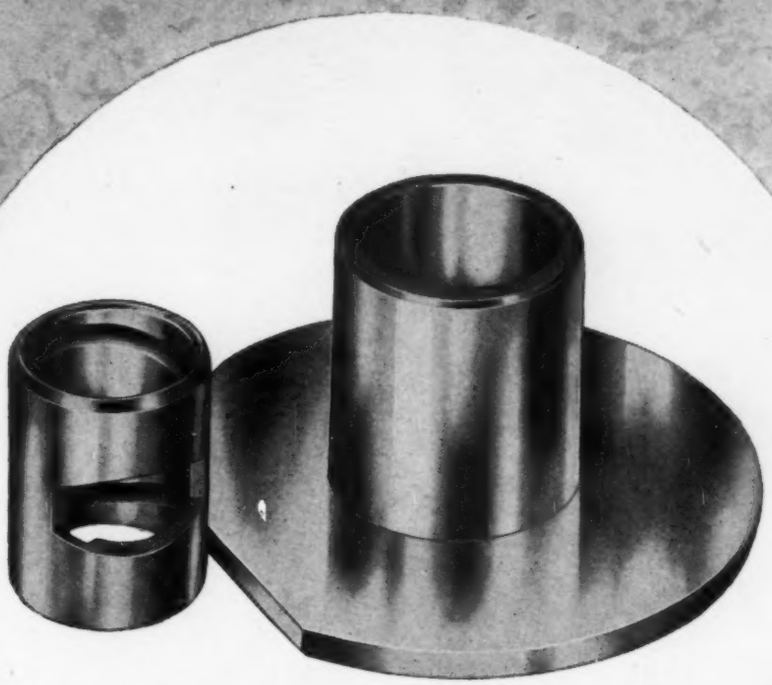
C. Paul Denckla has been appointed general sales manager for the Philadelphia office of the Dayton Rogers Manufacturing Co., Minneapolis, Minn., succeeding the late **E. Graepp. Marvin C. Barnum** has been named New York representative for the firm.

Charles J. Sauter and **W. Paul Moorhead** have been named district agents for the Worcester Pressed Steel Co., Worcester, Mass. Mr. Sauter, who is covering New York and northern New Jersey, is located at 17 East 42nd St., New York, while Mr. Moorhead will represent the firm in northern New England, with headquarters at the company plant.

Eugene S. Bogart has been transferred from the Pittsburgh office of the Link-Belt Co. to Baltimore, where he will serve as district sales manager. He succeeds **H. Merrill Bowman,** who is now assistant divisional sales manager for power transmission equipment with headquarters at the company's Pershing Rd. plant, Chicago.

R. L. Lefevre, formerly manager of the Washington, D. C., branch sales office of the General Electric X-Ray Corp., Milwaukee, Wis., has become head of the firm's sales department. **G. W. Happe,** formerly assistant to the vice president in charge of sales, has been named manager of the newly-created products department.

N. F. Vanderlipp has been named factory manager of The Glenn L. Martin Co., Baltimore, Md.



Standardize for Saving

Bunting Cast Bronze Bearings are available in two general types—the Bunting Standard Stock Bearing (822 sizes) and Bunting Special Bronze Bearings—tailored to your design and alloy.

Which from your view point is more desirable depends on several considerations. Can you use our standard alloy Bunting No. 72 (S.A.E. 660) or is a special alloy indicated. Can you use our stock dimensions and tolerances or does your design require a special bearing made expressly for you? Are your quantity needs moderate? If so, the Bunting Standard Stock bearing offers you the benefit of other's volume. Are your quantity needs substantial? If so, a special Bunting Bronze Bearing will cost no more than a Standard Stock Bearing.

One thing to remember about Bunting Bronze Bearings is this—your design is not penalized by a standardization for some other industry. Some bearing types have standardized to suit one industry and force other industries into straight-jacket designs, but Bunting Bronze Bearings offer freedom and latitude for the design needs of every industry. The Bunting Brass & Bronze Co., Toledo 9, Ohio. Branches in Principal Cities.

Bunting

BRONZE BEARINGS
•
BUSHINGS
•
PRECISION BRONZE BARS

82

Compare

THESE RESULTS WITH YOUR BEST!

A Lovejoy Type "F" Slotting Cutter with Tungsten Carbide-tipped blades used for milling slots in forged steel connecting links produced the amazing results that follow:

Workpiece: Connecting link used in mining machinery (see insert)

Material: SAE 3145 Forging

Hardness: 190–200 BHN

Operation: Mill slot 1 1/16" wide x 2 1/4" deep*
*Milled in one pass from solid metal section

Cutter: Lovejoy Type "F", T.C.T. Slotting Cutter 10" diameter

Speed: 117 r.p.m. (306 SFM)

Feed: 7.75 r.p.m. (.0065" per tooth)

Rate of Metal Removal: 21.8 cu. in. per minute

Finish: Excellent (no further finishing operations required)

A full description of this outstanding production tool is contained in the new Lovejoy Catalog No. 28. *Write for it today.*

"TOOL BITS"

Lovejoy has prepared a data sheet covering all blades for Lovejoy Type "L", "A" and "H" face mills. It has, in convenient form, all necessary information for reordering these blades. Also there are all the data on rake, bevel and working angles, both radial and axial needed for proper resharpening of the blades. In addition, the data sheet graphically illustrates the economies afforded by standard Lovejoy blades because they are interchangeable in a wide size range of Lovejoy cutters. The sheet is yours for the asking — send for it today.

Lovejoy
TOOL COMPANY, INC.
SPRINGFIELD, VERMONT

BUSINESS ITEMS

International Harvester Co. has purchased the **Metropolitan Body Co.**, Bridgeport, Conn., which will become a wholly-owned subsidiary of the Chicago firm. **Gen. Levin H. Campbell, Jr.**, executive vice president of Harvester, is chairman of the board, while **W. C. Schumacher**, general manager of Harvester's truck division, will be president of Metropolitan.

Reliance Electric & Engineering Co., Cleveland, has purchased from the **Detroit Steel Corp.** the steel warehouse and distributing plant located at 1170 Ivanhoe Rd., Cleveland, to increase production of larger electric motors, generators and V-S Drives.

Hewitt-Robins, Inc., New York has organized a new division, **Robins Engineers** to handle the contracting phases in the design, engineering and installation of materials handling and processing plants.

The Yoder Co., Cleveland, is creating a new forming roll department due to the increasing need in metalworking of these sets.

The Chicago Pneumatic Tool Co. will start construction of a new plant in Utica, N. Y., this spring. The plant will employ 2,000 people and have over 500,000 sq. ft. of floor space.

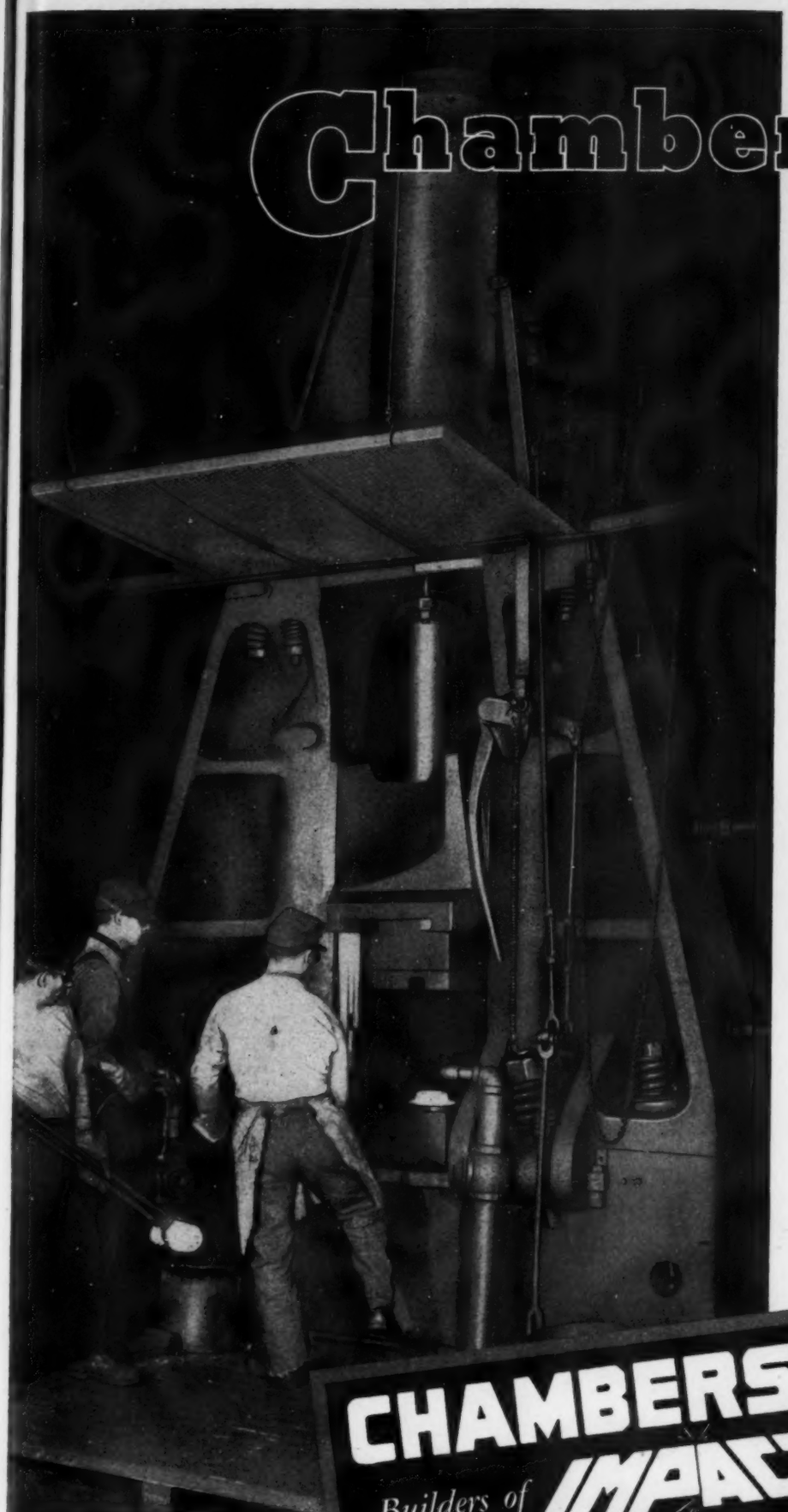
International Detrola Corp., Detroit, has purchased a surplus government furnace steel plant at Newport, Ky., for conversion into an open hearth plant with an eventual capacity of 720,000 ingot tons per year.

The Elmira Foundry Co., Inc., Elmira, N. Y., has been made an integral part of the **General Electric Co.** and becomes one of the nine major works composing the Apparatus Dept. **Ralph H. Roberts** continues as manager of the foundry works.

Timken Roller Bearing Co., Canton, Ohio, will start construction of a 67,000 sq. ft. addition to its St. Thomas, Ont., Canada, plant, which will be used for carburizing and hardening operations.

Columbia Steel Co. has purchased a surplus aluminum reduction plant in Torrance, Calif. Columbia plans to remove several buildings and build a cold steel rolling mill.

Buffalo Stainless Casting Corp. has been formed in Buffalo, N. Y., with **Donald M. Scott**, former manager of the Buffalo plant of Allegheny-Ludlum Steel Corp. plant, as president.



Chambersburg

Steam Drop Hammer

...more forging per blow

...more blows per minute

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CHAMBERSBURG • PENNSYLVANIA

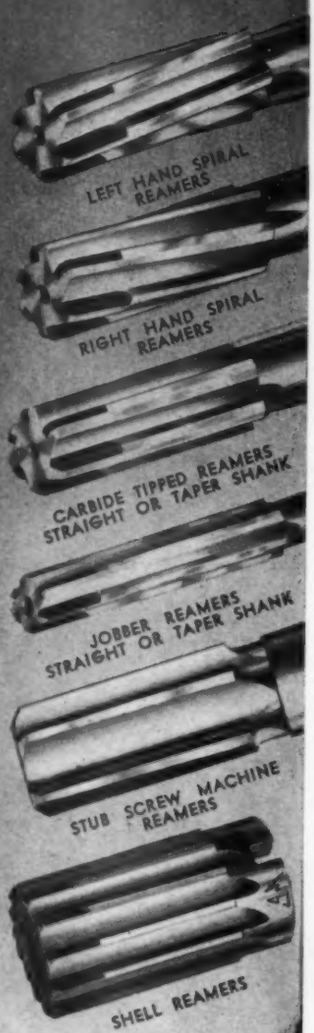
CHAMBERSBURG
Builders of **IMPACT** *Machinery*

WENDT SONIS

Line of Reamers

IS COMPLETE

CARBIDE FULL LENGTH FLUTE REAMERS STRAIGHT OR TAPER SHANK

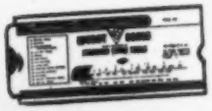

LEFT HAND SPIRAL REAMERS
RIGHT HAND SPIRAL REAMERS
CARBIDE TIPPED REAMERS STRAIGHT OR TAPER SHANK
JOBBER REAMERS STRAIGHT OR TAPER SHANK
STUB SCREW MACHINE REAMERS
SHELL REAMERS

- COMPLETE RANGE OF SIZES
- WIDE SELECTION OF STYLES
- HARDENED STEEL SHANKS
- ADVANCED DESIGNS

The W-S line of reamers is so complete that they can meet practically all your reaming requirements. For example, W-S Straight Shank Reamers style SSR are available from stock in 37 sizes ranging from 1/8" to 1½". Similar ranges of sizes are available in 12 other types of standard reamers. Quick delivery can be obtained on standard reamers with special diameters and tolerances. "Engineered for the Job" design increases production and saves on tool costs. You get longer wear—greater accuracy when you select Wendt-Sonis Reamers for your requirements.

Free! W-S SPEED AND FEED CALCULATOR

Quickly figures feed and speeds on reaming and other operations. Write WENDT-SONIS COMPANY, Hannibal, Missouri, —580 North Prairie Ave., Hawthorne, Calif. — 1361 West Lake St., Chicago, Ill.



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OBITUARIES

Percy T. Oldham

Percy T. Oldham, 58, manager of the Marine Division for Lukens Steel Co., and its divisions, died of a heart attack Jan. 18. Mr. Oldham has been associated with Lukens since 1915 when he joined the firm as assistant construction engineer. He held numerous sales positions until being named to his latest post in 1946.

Carlton H. Talcott, 49, secretary of the Torrington Co., Torrington, Conn., and sales manager of the bearings division, died Jan. 13.

Howard W. Gilbert, 68, engineering assistant to the president of National Malleable & Steel Castings Co., Cleveland, died suddenly Jan. 16. He joined the firm in 1908 and spent most of the intervening years as manager of the inspection and test department.

Leo J. Greene, 60, assistant superintendent of production at Chisholm-Ryder Co., Inc., Niagara Falls, N. Y., died suddenly Jan. 11.

MEETINGS

American Society of Mechanical Engineers. Spring meeting. St. Charles Hotel, New Orleans, La. March 1-4. Ernest Hartford, executive assistant secretary, 20 W. 39 St., New York.

American Society of Tool Engineers. Sixth annual industrial exposition. Public Auditorium, Cleveland. March 15-19. J. M. Cannon, director of public relations, 1666 Penobscot Bldg., Detroit 26.

Pressed Metal Institute. Annual meeting. Hotel Statler, Buffalo, Feb. 10-11. Sam Morrison, vice president, Morrison Steel Products, Inc., Buffalo, chairman.

GEARED

to the correct production speed

Improved

STERLING SLO-SPEED

BALANCED DESIGN FOR EVERY HORSEPOWER RATING

Sterling is as well known for its precision gears as for the advanced engineering in its electric motors. From power intake to drive shaft, Sterling makes motor, gears, and all parts in one modern plant — giving you a highly efficient, slow-speed power unit for the "one best" correct production speed. Thousands of satisfied users are increasing plant profits with Sterling Slo-Speed geared motors.

Send for new informative literature.

UNDIVIDED RESPONSIBILITY . . . Experienced engineering — precision helical gears — liberal ball bearings — splash lubrication — and rugged construction are combined in this one compact, sturdy, dependable unit.

Improved Sterling Slo-Speed geared motors are available with single and double reduction gears in a wide variety of ratios.

Use the improved Sterling Speed-Trol—where "speed control" — faster or slower — is required.

Use the improved Sterling Klosd general-purpose motor — where one best constant normal speed is required.

STERLING ELECTRIC MOTORS

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THEY ALL AGREE ON HY-LOAD

THE BUILDERS

of today's finest equipment rel on Hyatt Roller Bearings to reduce friction and wear at important operating points. Because they have greater load carrying capacity . . . because their separable parts are freely interchangeable . . . because they are available in 10 major types . . . Hy-Loads help make possible more compact, more efficient, more economical design.

THE SELLERS

of today's finest equipment point out with pride that it's "Hyatt-equipped." With minimum care and maintenance, Hy-Loads outlast the equipment in which they are installed. Satisfied customers and freedom from service requirements mean profits for equipment dealers.

THE BUYERS

of today's finest equipment like the smoother, quieter performance . . . the reduced power requirements . . . for which Hy-Load Bearings are recognized in all types of machinery and equipment. For all-around satisfaction depend on Hyatt. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J. and Detroit, Mich.

HYATT ROLLER BEARINGS

never underestimate your need f AIR

This fellow did! But someone may save him yet. Perhaps it's his first experience, or maybe he didn't heed the warnings.

Did you ever stop to consider how essential *Air Power* is to your shop or factory? And how Compressors, Air Tools, and air appliances do wear out eventually, or become inefficient in comparison with modern ones?

Have you found so many uses for *Air Power* that your compressors and piping are too small, making your workers use air at low, less-efficient pressures? Remember too, your plant has grown . . . methods have changed.

At present you may be using very little air, or perhaps none at all, but never overlook the tremendous possibilities and advantages of Air Power. *Never underestimate your need for Air.* Call in an Ingersoll-Rand Air-Power Specialist. He can help you.

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When the Decimal Point

in Your Profit

DEPENDS ON

MACHINABILITY

. . . it's high time to specify Republic Union Cold Drawn Steels "right across the board" for *ALL* of your steel parts production.

Long ago, Union Drawn metallurgists and engineers learned that slight changes in cutting speeds and feeds, finish and tool life due to machining quality or variation can greatly affect net production obtained—*and thus the cost of finished steel parts.*

That's why *top* MACHINABILITY and *uniform* MACHINABILITY have been number one objectives at Republic's Union Drawn Steel Division for almost 60 years.

During this time, steel parts producers have benefited repeatedly through a steady increase in the MACHINABILITY of Union Cold Drawn Steels . . . through the development of new steels that machined faster than any ever produced before . . . through the compilation of authentic machining data available in the Union Drawn Steel Handbook for machine tool users . . . through the availability of *all types* of modern furnace treatments.

Today, MACHINABILITY still takes precedence over everything else in Union Drawn laboratories and mills. Intensified laboratory research extends even to the study of microscopic grain hardness both in the bar and in chips cut from it. Union Drawn metallurgists and machining engineers pursue their studies of individual problems in customers' plants—*and are ready to work with you in your plant.*

So next time you order cold drawn steel—Bessemer screw stock, a carburizing grade, alloy or stainless steel—remember the quality that stands out in Republic Union Cold Drawn Steels more than any other—MACHINABILITY.

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Union Drawn Steel Division • Massillon, Ohio
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REPUBLIC STEEL
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UNION COLD DRAWN STEELS

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Free-Machining Bessemer, Alloy and Enduro Stainless Steels
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Union Cold Drawn Special Sections
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Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting.)

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

DIVCO improves production set up

with **LAKE ERIE** Hydraulic Press

DIVCO delivery trucks on final assembly line. These vehicles are noted for their efficient operation... and the efficiency with which they are produced.

The new automatic and semi-automatic hydraulic presses manufactured by Lake Erie are designed to provide metal working plants with production machinery that will (1) increase plant output (2) improve product quality and (3) decrease manufacturing costs. The ability of these new, fast presses to accomplish this is being demonstrated every day in leading automotive, farm machinery, home appliance and other metal working plants. Lake Erie's complete line of hydraulic presses includes models for every manufacturing need. Our engineering staff will be glad to provide detailed specifications and assistance in the selection and application of presses to meet your specific needs.

FORMING a side panel and fender unit in the Lake Erie Press. The panel is formed in a single, fast operation out of 20 gage sheet steel.

COMPLETED side panels and fender units. Both right and left panels and other body parts are formed on the Lake Erie Press.

LAKE ERIE ENGINEERING CORP.

MANUFACTURERS OF
HYDRAULIC PRESSES AND SPECIAL MACHINERY

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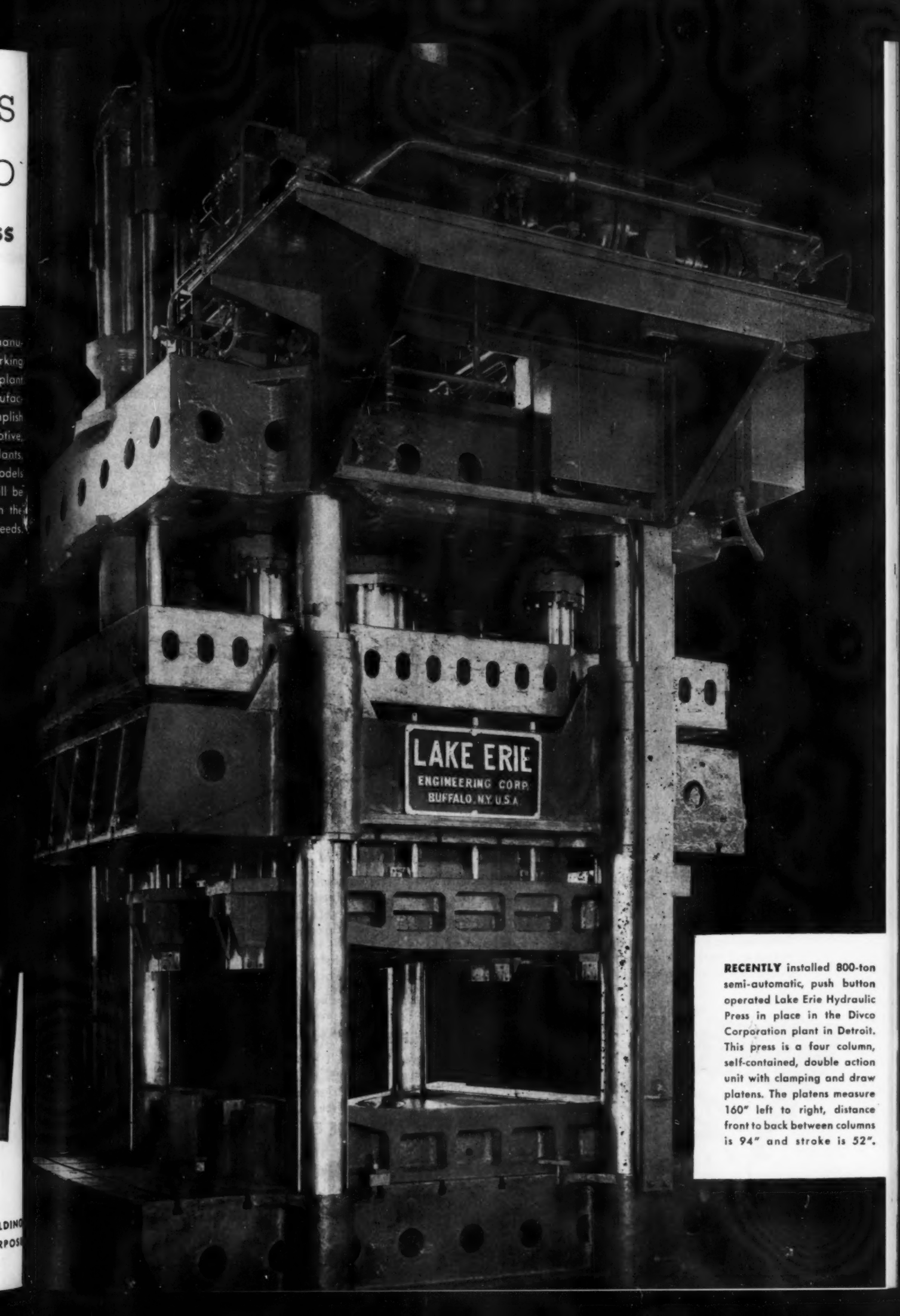
LEADING MANUFACTURER OF HYDRAULIC PRESSES — ALL SIZES AND TYPES — METAL WORKING... PLASTICS MOLDING FORGING... METAL EXTRUSION... PROCESSING... RUBBER VULCANIZING... STEREOTYPING... SPECIAL PURPOSE



RECENTLY installed 800-ton semi-automatic, push button operated Lake Erie Hydraulic Press in place in the Divco Corporation plant in Detroit. This press is a four column, self-contained, double action unit with clamping and draw platens. The platens measure 160" left to right, distance front to back between columns is 94" and stroke is 52".

All Around The Town...They're Demanding

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Look for this Label in Your Uniforms, Utility and Work Clothes!

YOUR uniformed personnel look better, feel better and work better with clothing made of durable, smart looking Reeves Army Twill. Its high tensile strength assures rugged wearability with long-lasting economy. Vat dyed colors are fast to sun, water and perspiration. Sanforized Shrunk*, Reeves Army Twill retains smart tailoring after repeated washings. Remember—over 90 million yards of this same fabric helped equip America's fighting men—exceeding Government specifications under the toughest climatic conditions.

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Write for names of manufacturers specializing in uniforms and work clothes for your industry.

**Residual shrinkage less than 1%.*

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SPINNING WEAVING DYEING FINISHING Reeves FABRICS

THE REEVES FABRIC GROUP INCLUDES:

Reeves Army Twill • Reeveking Gabardine
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- ★ STANDARD CAP SCREWS
- ★ HARDENED AND PRECISION GROUND PARTS
- ★ SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST
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AT BOOTH 1015
TOOL ENGINEERS' INDUSTRIAL EXPOSITION

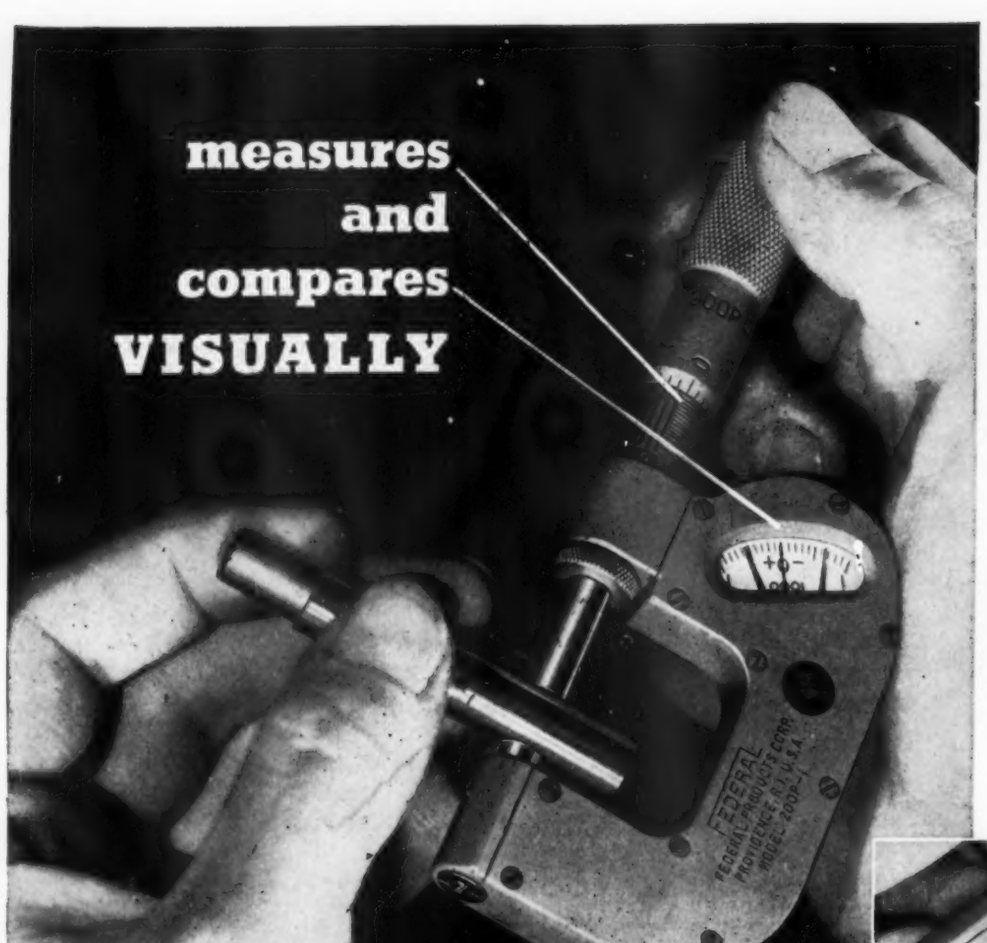
ALLIED WITH MASS PRODUCTION

At the A.S.T.E. Show in the Cleveland Auditorium in March, you will have the opportunity to learn first-hand the many ways in which Allied's products and services can contribute to lower costs and greater production efficiency in your plant. As a reminder to visit our booth, it is a suggestion that you tear out this advertisement and drop it in the briefcase that you will carry to Cleveland.

If you are unable to attend the Exposition, we will be glad to mail you full information on any or all of the products listed above.

ALLIED PRODUCTS CORPORATION
DEPARTMENT 38
4612 LAWTON AVENUE, DETROIT 8, MICHIGAN

ALLIED CORPORATION PRODUCTS — PRECISION · EXPERIENCE · DEPENDABILITY



without errors of "feel"

With this Indicating Micrometer, you *see* rather than *feel for* the dimension. You know when you're right . . . In a top quality micrometer you have a Dial Indicator which *shows* the precise measurement in tenths (.0001"). This eliminates the human variations in setting the spindle at its required uniform pressure.

You get four additional positive advantages. First, by retracting the lower anvil with the push button, you have a snap gage to use on job lots. Second, the tolerance hands on the dial make it easier to determine the dimensions which are within tolerance. (This is a natural for Statistical Quality Control.) Third, you get Tungsten Carbide Anvils. Fourth, all except the spindle is finished in beautiful, rust-proof dull chrome.

The Federal Indicating Micrometer is a basic instrument you need today. We invite you to write for a descriptive folder.

Retracting this button enables you to use the Indicating Micrometer as a snap gage on job lots

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Offers Better Cutoff Wheels To Speed Up Difficult Jobs

This folder provides complete specifications for cutoff grinding . . . Ask for your copy!

You can cut off metals and non-metals more efficiently with Sterling's "Wheels of Industry" . . . they are engineered to do a better job of it—quickly!

These superior cutoff wheels lower costs on many jobs because they usually make a second grinding for finish unnecessary. They are accurate, cutting bar stock to within 0.005-inch. In comparison with other methods, they are much faster, often doing jobs twelve times quicker! Unannealed alloy steels can be readily cut off with Sterling Cutoff Wheels.

Save time, money and material by specifying and using Sterling . . . for wet or dry cutting off, they are the best obtainable.

An analysis of your problem can be readily obtained. Write us today for the free services of a Sterling engineer . . . his years of experience are yours for the asking.

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THE STERLING GRINDING WHEEL DIVISION
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TIFFIN, OHIO

THE WHEELS OF INDUSTRY

Get this Valuable Kit absolutely

FREE!

PROVE THEM ON YOUR TOUGHEST OPERATIONS *at our* Expense

Solve

PRECISION LAPPING PROBLEMS

With this trial carton your own experience will tell you why these finer quality, finer grit compounds are *right* for all precision lapping. Carton contains six grades of compounds, all fine grit sizes best suited to a variety of work. Mailed postpaid anywhere in U.S.A. No obligation. Write today.

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help you get GREATER EFFICIENCY on your machines

To the right is a 16" Ledge & Shipley Selective Head Engine Lathe equipped with a Model 2-P3 Long, 1/10 HP Gusher Coolant Pump.

To the left is a Baush Three-Spindle Vertical Boring Machine equipped with a Model 11025 Ruthman Gusher Coolant Pump.

Oversized prelubricated bearings requiring no further lubrication, electronically balanced, one-piece rigid shaft, no metal-to-metal contact gives greater efficiency in Ruthman Gusher Coolant Pumps. You are sure of years of trouble-free service at low maintenance cost when you specify Ruthman Gusher Coolant Pumps on your metal-cutting machinery

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For Faster Smoother Cleaner *Grinding*

ECONOMY

W&B Co.

Grinding and Cutting Oils and Lubricants for Every Metal Working Purpose

THE WHITE & BAGLEY COMPANY
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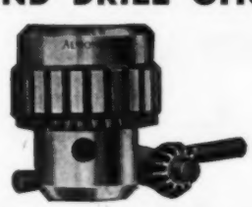
ALMOND DRILL CHUCKS



Maximum Gripping Power with Extreme Accuracy and Long Life

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T. R. ALMOND MFG. CO.
Ashburnham, Mass., U.S.A.

CARLTON RADIAL DRILL

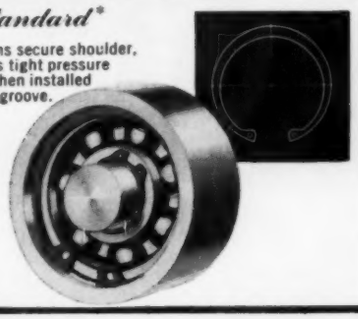
FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

THE CARLTON MACHINE TOOL COMPANY
CINCINNATI 25, OHIO, U. S. A.

Waldes Truarc Retaining Rings
Now Nationally Distributed, Nationally Stocked

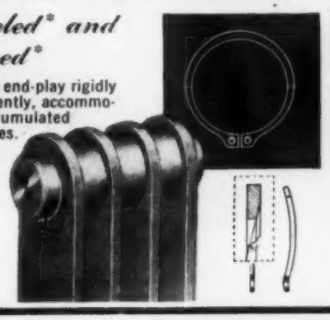
*Standard**

Forms secure shoulder, gives tight pressure fit when installed in a groove.



*Beveled** *and* *Bowed**

Take up end-play rigidly or resiliently, accommodate accumulated tolerances.



Crescent

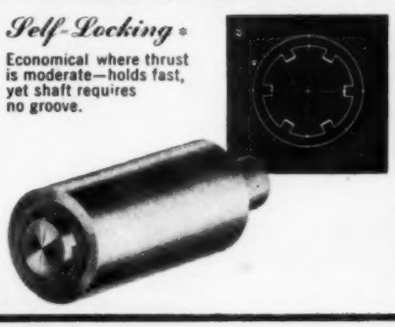
Snaps on radially where axial assembly is impossible. No special tools needed.

E-Ring

Provides large strong shoulder for small shafts. Applied radially.

*Self-Locking**

Economical where thrust is moderate—holds fast, yet shaft requires no groove.



Interlocking

2-piece ring takes heavy thrusts, gives positive lock, secure against high RPMs.

*Inverted**

For bearings with large corner radii, uniform shoulder for curved abutting surfaces.

*Available for both internal and external application

There's a Waldes Truarc precision-engineered retaining ring to answer every need. Truarc rings give a never-failing grip because of their mathematically precise construction. No matter how demanding your specifications, it's a simple matter to refine your present designs to save material, machining and assembly costs. And now it's more convenient for you too—there's a distributor near you who stocks the rings you need. See the list below. Send your design problem to Waldes Truarc engineers, who will give it individual attention without obligation.

ONE OF THESE AUTHORIZED DISTRIBUTORS IS CONVENIENT TO YOU:

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Atlanta, Ga., Moffatt Bearings Co.
Baltimore, Md., Moffatt Bearings Co.
Birmingham, Ala., Moffatt Bearings Co.
Bluefield, W. Va., W. Virginia Bearings, Inc.
Boston, Mass., Tek Bearing Co., Inc.
Bridgeport, Conn., Tek Bearing Co., Inc.
Buffalo, N. Y., Syracuse Bearings Co.
Canton, O., The Ohio Ball Bearing Co.
Charleston, W. Va., W. Virginia Bearings, Inc.
Charlotte, N. C., Moffatt Bearings Co.
Chicago, Ill., Berry Bearing Co.
Cincinnati, O., The Ohio Ball Bearing Co.
Cleveland, O., The Ohio Ball Bearing Co.
Columbus, O., The Ohio Ball Bearing Co.
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Huntington, W. Va., West Virginia Bearings, Inc.
Indianapolis, Ind., Indiana Bearings Inc.
Ironton, O., The Ohio Ball Bearing Co.
Lafayette, Ind., Indiana Bearings Inc.
Lima, O., The Ohio Ball Bearing Co.
Loram, O., The Ohio Ball Bearing Co.
Los Angeles, Calif., Edward D. Maltby Co.
Mansfield, O., The Ohio Ball Bearing Co.
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Oakland, Calif., Bearing Specialty Co.
Peoria, Ill., Illinois Bearing Co.
Philadelphia, Penn., Moffatt Bearings Co.
Phoenix, Ariz., Edward D. Maltby Co.
Pittsburgh, Penn., Pennsylvania Bearings Inc.
Portland, Ore., O. W. I. Corporation
Providence, R. I., Tek Bearing Co., Inc.
Richmond, Va., Moffatt Bearings Co.
Rochester, N. Y., Syracuse Bearings Co.
St. Louis, Mo., Neiman Bearings Co.
Salt Lake City, Utah, Bearings Service Supply Co.
San Francisco, Calif., Bearing Specialty Co.
San Diego, Calif., Edward D. Maltby Co.
Seattle, Wash., Bearing Engineering & Supply Co.
Shreveport, La., Bearing & Transmission Co.
South Bend, Ind., Bearings Service Co.
Syracuse, N. Y., Syracuse Bearings Co.
Terre Haute, Ind., Indiana Bearings Inc.
Toledo, O., The Ohio Ball Bearing Co.
Toronto, Ont. Can., Controlite Engr. & Sales Ltd.
Wheeling, W. Va., West Virginia Bearings, Inc.
Youngstown, O., The Ohio Ball Bearing Co.
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Factory engineering representatives available in each area

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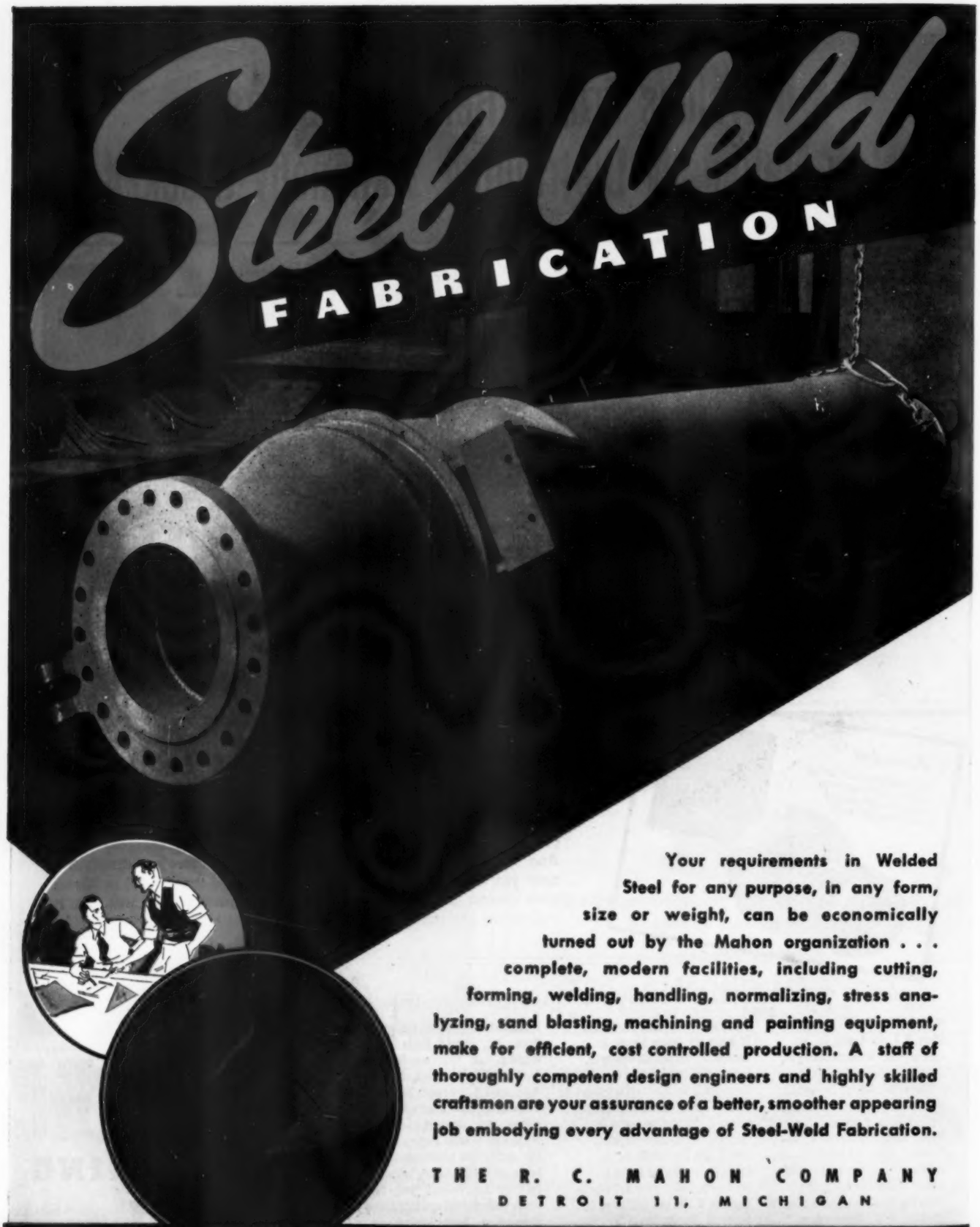
TRUARC
RETAINING RINGS

WALDES KOHINOOR, INC.
LONG ISLAND CITY 1, N. Y.

WALDES TRUARC RETAINING RINGS ARE PROTECTED BY U.S. PATS. 2,302,948; 2,026,484; 2,416,852 AND BY OTHER PATS. PENDING.

Steel-Weld FABRICATION



Your requirements in Welded Steel for any purpose, in any form, size or weight, can be economically turned out by the Mahon organization . . . complete, modern facilities, including cutting, forming, welding, handling, normalizing, stress analyzing, sand blasting, machining and painting equipment, make for efficient, cost controlled production. A staff of thoroughly competent design engineers and highly skilled craftsmen are your assurance of a better, smoother appearing job embodying every advantage of Steel-Weld Fabrication.

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Engineers and Fabricators of Welded Steel Machine Bases and Frames, and Many Other Welded Steel Products

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Time saver—

money maker—

easier—

faster!—

—write them today!

Foundry and metal-fabricating shop operators are overwhelmed with their increased piece work production from BAYFLEX RAISED HUB DISC WHEELS.

Yes, where heavy duty portable grinders and sanders are used the jobs can now be done much faster—easier—cleaner. No wonder that BAYFLEX is so popular with management and operators alike!

The merits of this new product are many . . . the production possibilities unlimited. To appreciate the full value of BAYFLEX however, you must see it in operation. Ask for a demonstration at your plant. No obligation.

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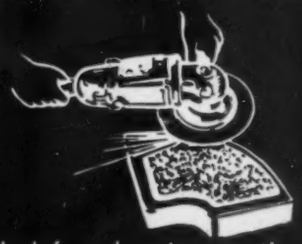
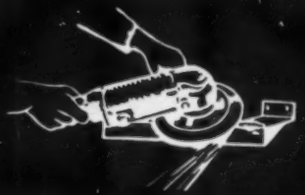


Unexcelled for cleaning castings.



For welds on angle-iron frames.

For hard-to-get-at places.

Has no equal for smoothing welds.

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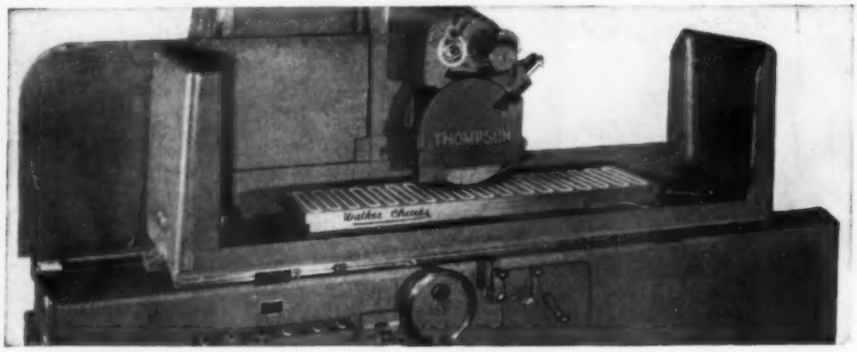
BAY STATE ABRASIVE PRODUCTS CO.,



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The exacting demands of the Thompson Grinders are met by the holding power of the WALKER CHUCKS.

Sixty years of chuck design and manufacturing, qualify WALKERS to solve your holding problems.

Remember—there is a WALKER CHUCK for every known magnetic application. Contact our engineers . . .

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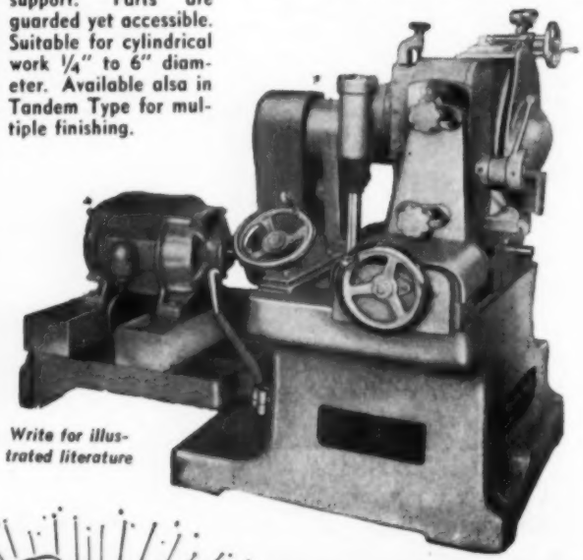
Original Designers and Builders of Magnetic Chucks

***. . . for work of superior quality use the* No. 101 "PRODUCTION"**

This fast, simple and automatic machine requires no centering, chucking or holding of work. It is fed automatically, assures better finishing at lower cost, and is adaptable to polishing, finishing and buffing any cylindrical work.

The No. 101 is substantially built and is equipped with device for turning wheels while in motion and with adjustable work support. Parts are guarded yet accessible. Suitable for cylindrical work ¼" to 6" diameter. Available also in Tandem Type for multiple finishing.



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They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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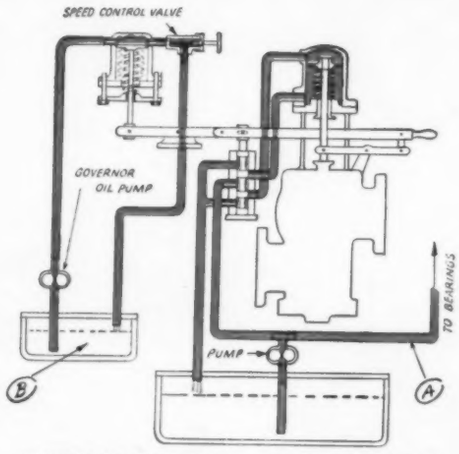
CASE 1048—STOPPING RUSTING, LACQUERING, SLUDGING IN STEAM TURBINES.



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Charges of inhibited Calol OC Turbine oil in various size turbines gave service many times longer than normally obtained with straight-mineral oils. Use in large and small units ... ring-oilers, circulating oil lubricating systems and oil-actuated governor relay systems. Comes in five grades: 5, 9, 11, 15, 19.

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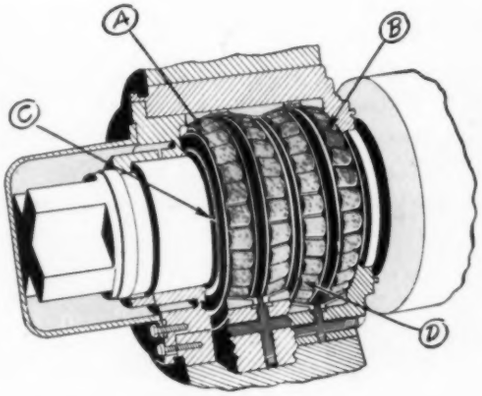
Calol OC Turbine Oil in regular service showed no increase in acidity after several years ... turbine parts remained in same condition as when installed ... water and solid contaminants separated readily from oil in centrifuging or filtering systems.

CASE 1047--KEEPING GREASE IN BEARINGS WHERE TEMPERATURES AND PRESSURES ARE EXTREME.



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When the temperature in a roll neck bearing reached more than 200°F., Calol E.P. Roller Grease did not run out. Excellent for all heavy-duty, grease-lubricated anti-friction bearings. Handles easily in pressure systems at all operating temperatures.

A. Contains extreme pressure additives. Lubricating film will not squeeze off under the heaviest loads.

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C. Melts slowly and feeds evenly ... creeps into small clearances and assures adequate lubrication.

D. Will not corrode bearing metals.

Calol E.P. Roller Grease is made specially to meet conditions of heat and pressure too high for other conventional anti-friction greases.

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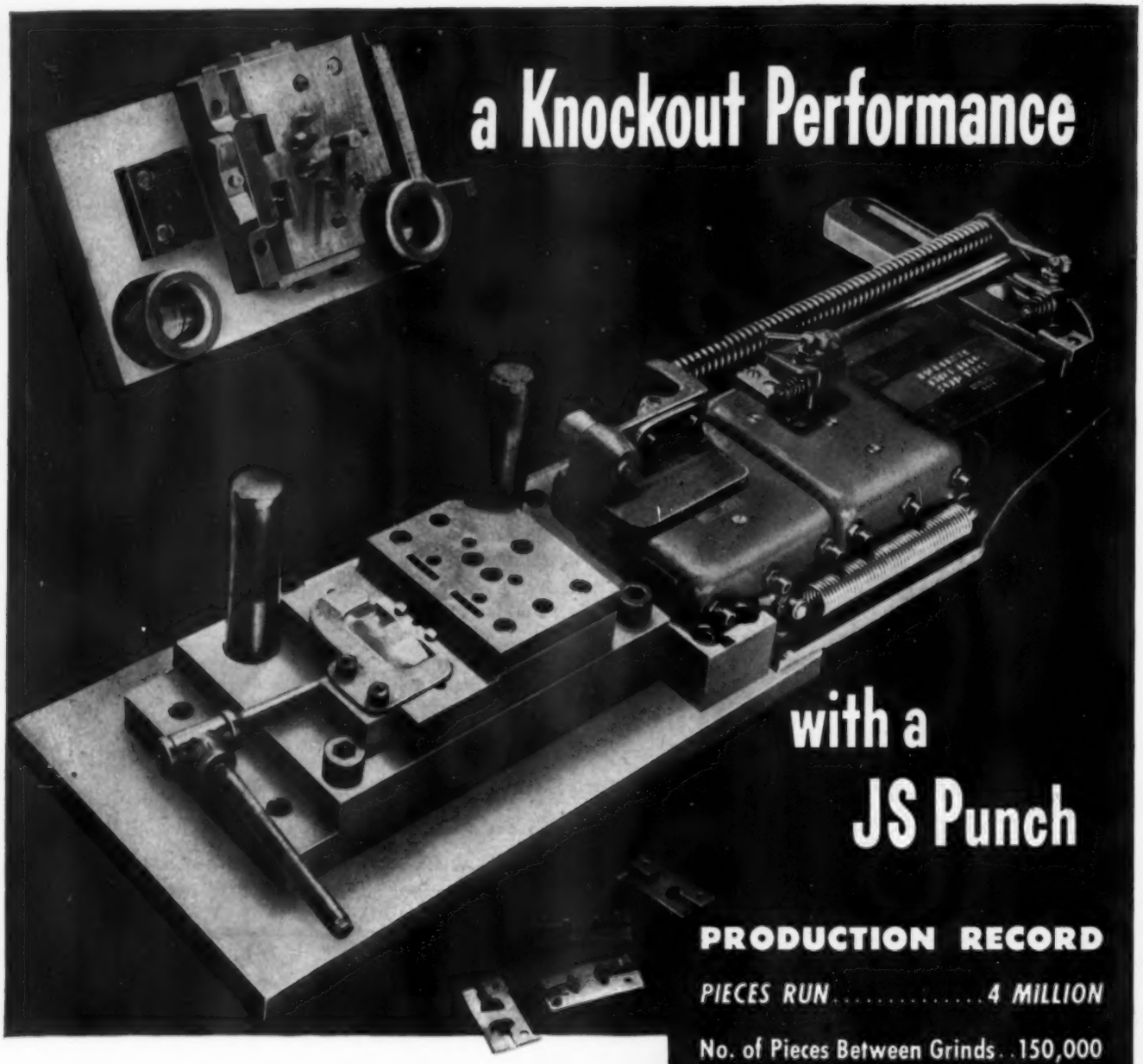

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PIECES RUN.....4 MILLION

No. of Pieces Between Grinds..150,000

Speed.....135 strokes per minute

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Punches and Cut-off Knives
.....J-S Chisel and Punch Steel

The Die is still in excellent condition

As evidenced above, J-S Chisel and Punch Steel —an oil-hardening steel for both hot and cold work—is exceptionally tough . . . stands up remarkably to fatiguing effect of repeated blows ...excellent for punches and for chisels, cutters, shear blades, pneumatic tools, etc.

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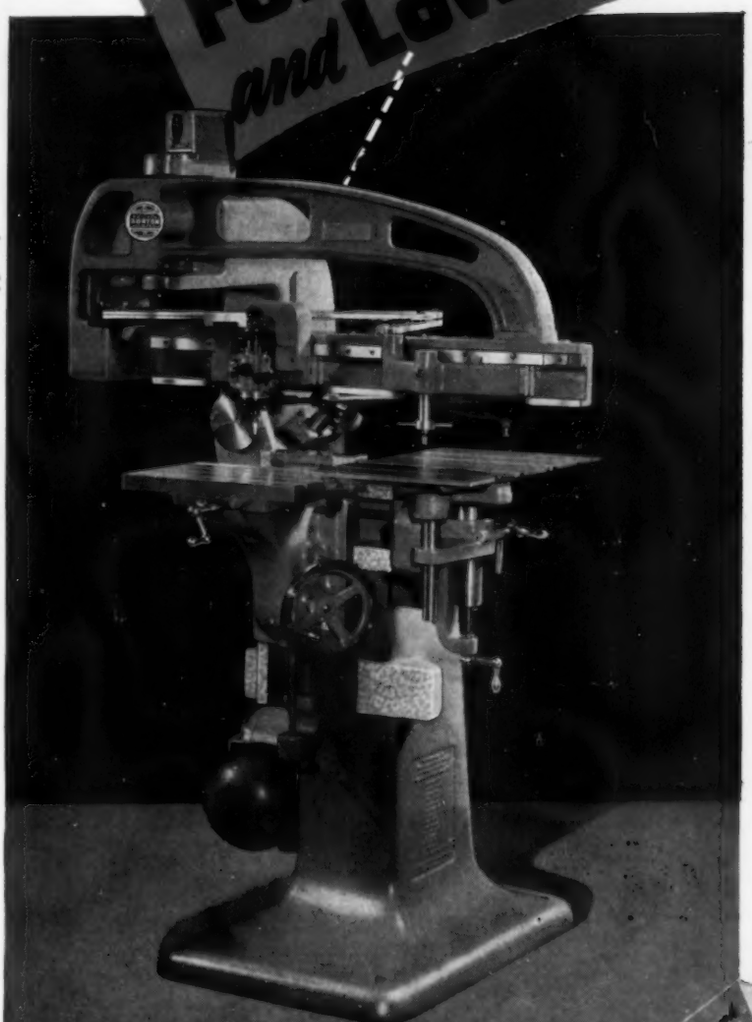

The P13 PANTOGRAPH for 3-Dimensional Light Milling and Engraving

This revolutionary machine features the new and exclusive *RATIOBAR Tracer Control — the first basic design improvement in pantograph construction since the first pantograph was built.

Manufacturers of small intricate dies, molds, hobs, stamps and other related products placed firm orders sufficient to take all of the first production run after inspecting the pilot model—real proof of the value built into the P13.

What is *RATIOBAR tracer Control?

*RATIOBAR Tracer Control is the name for the newly developed principal of control, found only on the Gorton P13. It does three important things: permanently aligns the pivot center, cutter spindle and tracing style in an absolute straight line without guessing or innumerable adjustments; enables the operator to set reduction ratios with just one slider block; it provides rigid support for all pantograph linkages. No other manufacturer offers these advantages in a pantograph.

Easier operation and better balance are also assured with the *RATIOBAR because linkages move toward the pivot center as the tracer moves out and away from it. For detailed information, use the coupon below.

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Here's complete data on the new Gorton P13 as well as other Gorton pantographs. Use this coupon or write for Bulletin 1580 today — it will pay you well.

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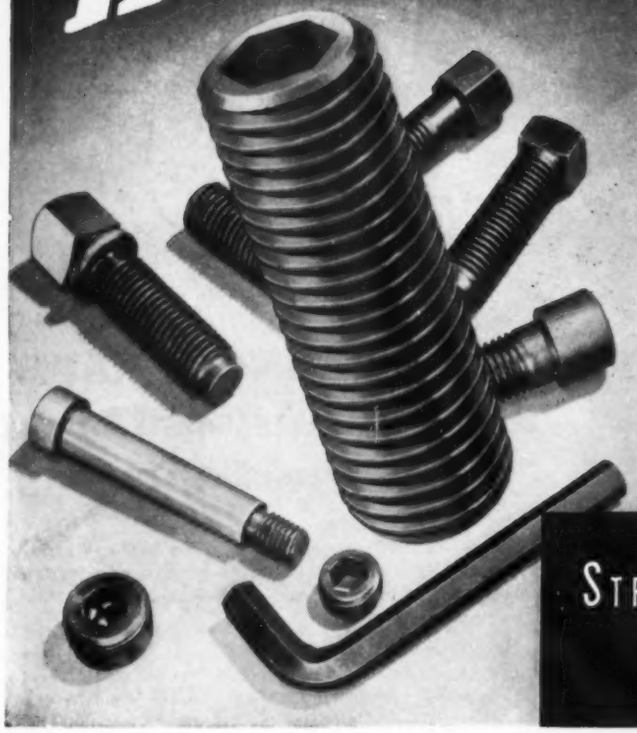

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Mac-it Hollow Set Screws will solve your toughest holding-down problems where flush surfaces, compact construction and a neat appearance are factors. *All* Mac-it screws are heat-treated and accurately made with die-cut threads. Whatever your needs, let the *complete* Mac-it line serve you. Sold through recognized distributors from coast to coast and in Canada.

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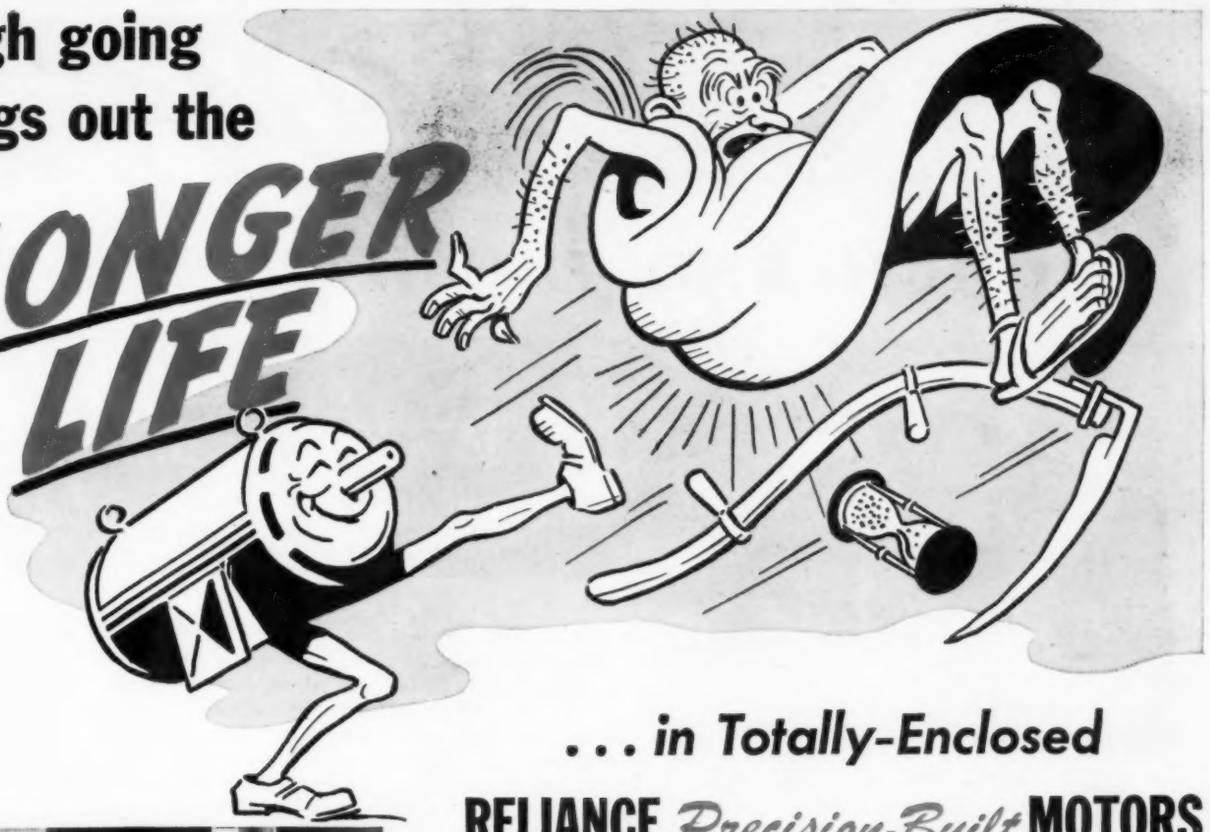

. . . in Totally-Enclosed

RELIANCE *Precision-Built* MOTORS

Wherever motors operate frequently under abnormal conditions, Totally-Enclosed, Fan-Cooled Reliance A-c. Motors continually amaze users by their longer life. That important extra protection they have—against moisture in the air, against liquids splashed or streamed right on them, against dust and abrasives—pays so much more than it costs!

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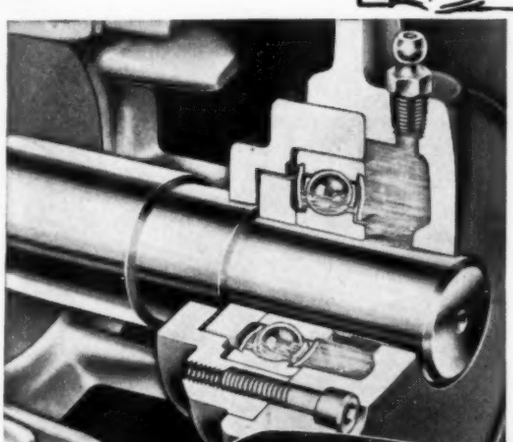
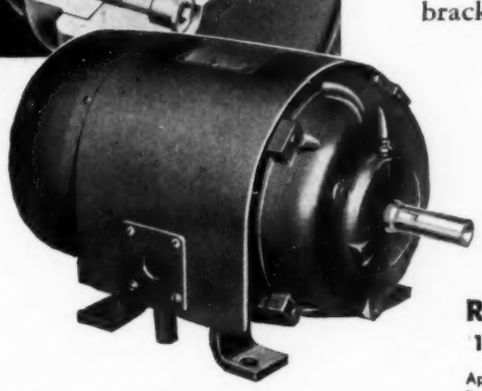


This special bearing design protects Reliance Precision-Built Motors indefinitely!



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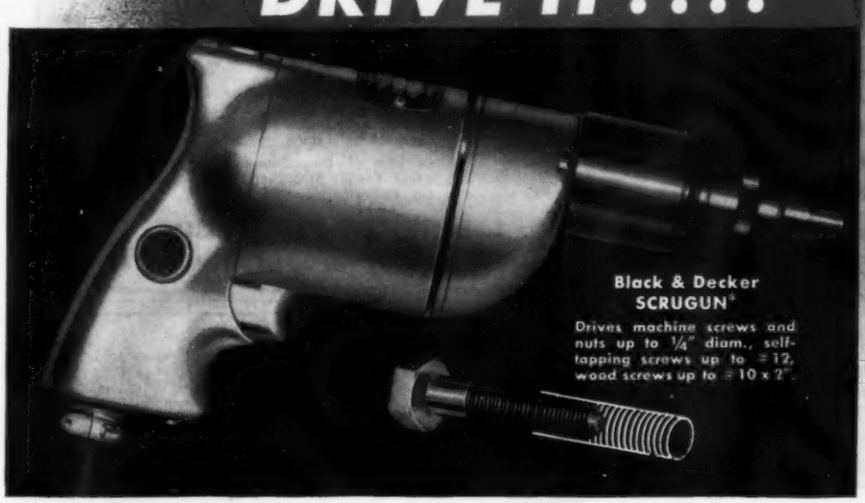

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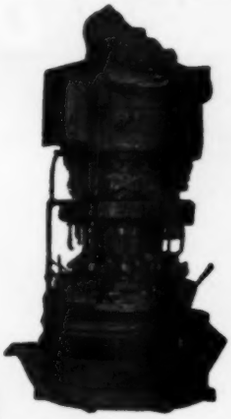
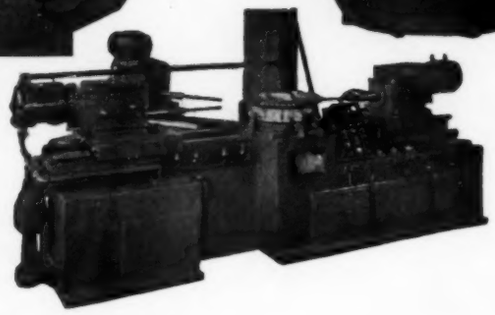


MULTIPLE SPINDLES



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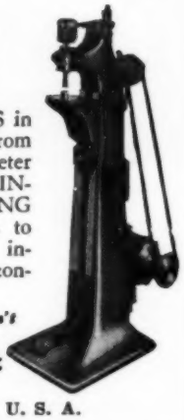

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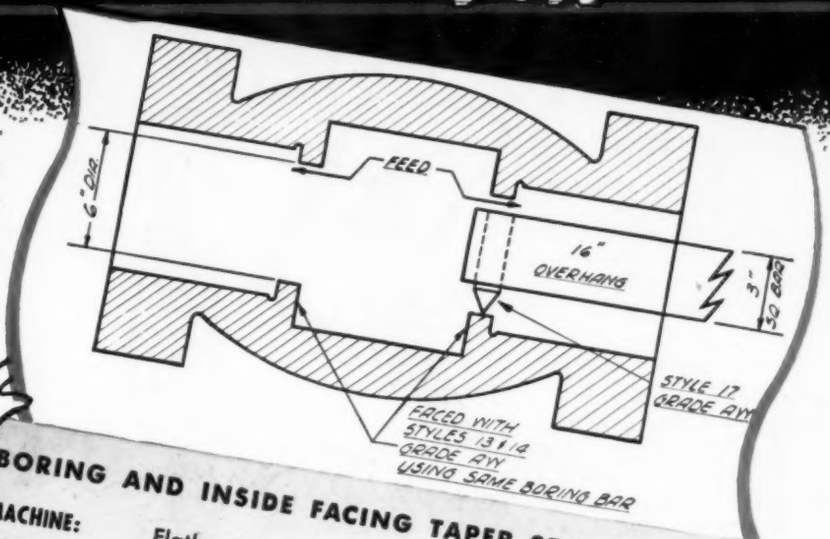

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MATERIAL:	Tough Cast Iron
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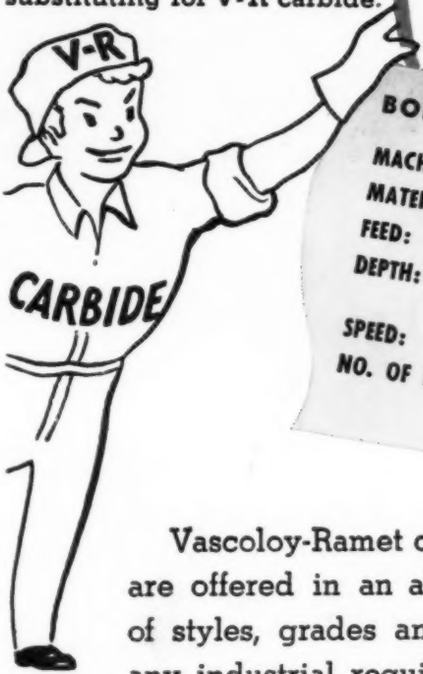
DEPTH:	On Bore — 3/16" to 1/4" on a Side (as much as 3/8" due to castings being non-concentric)
SPEED:	100 S. F. M.
NO. OF PIECES:	40 Pieces Between Grinds with V-R Grade AW Less Than 1/2 Piece with Substitute



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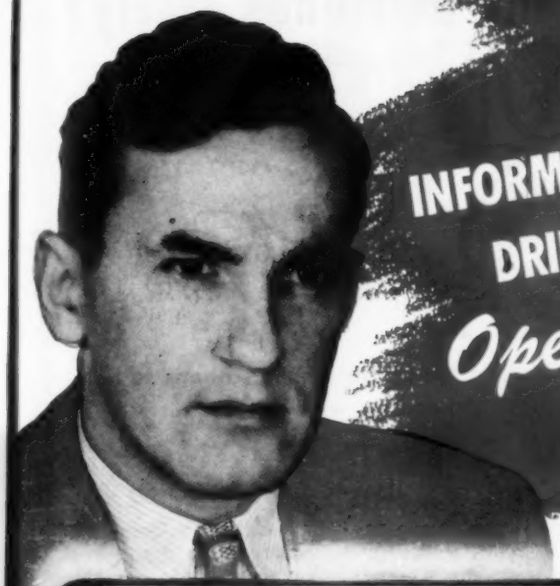

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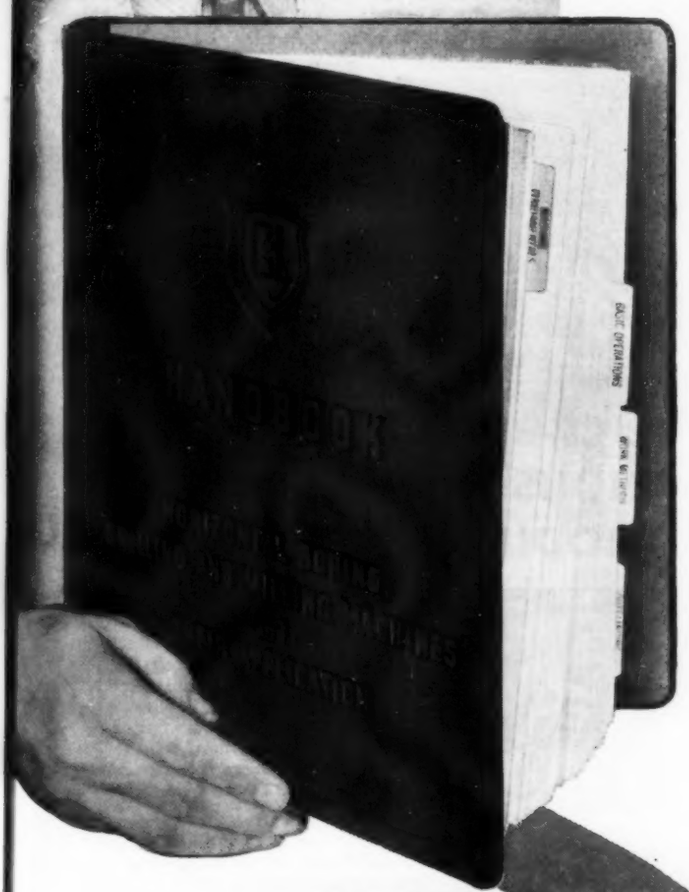

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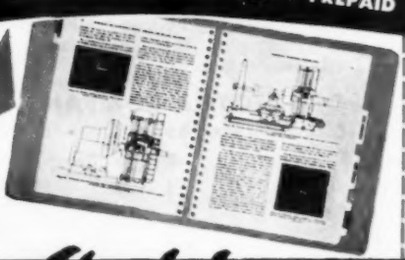

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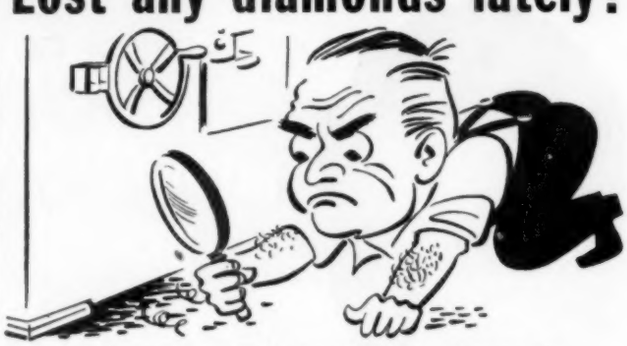

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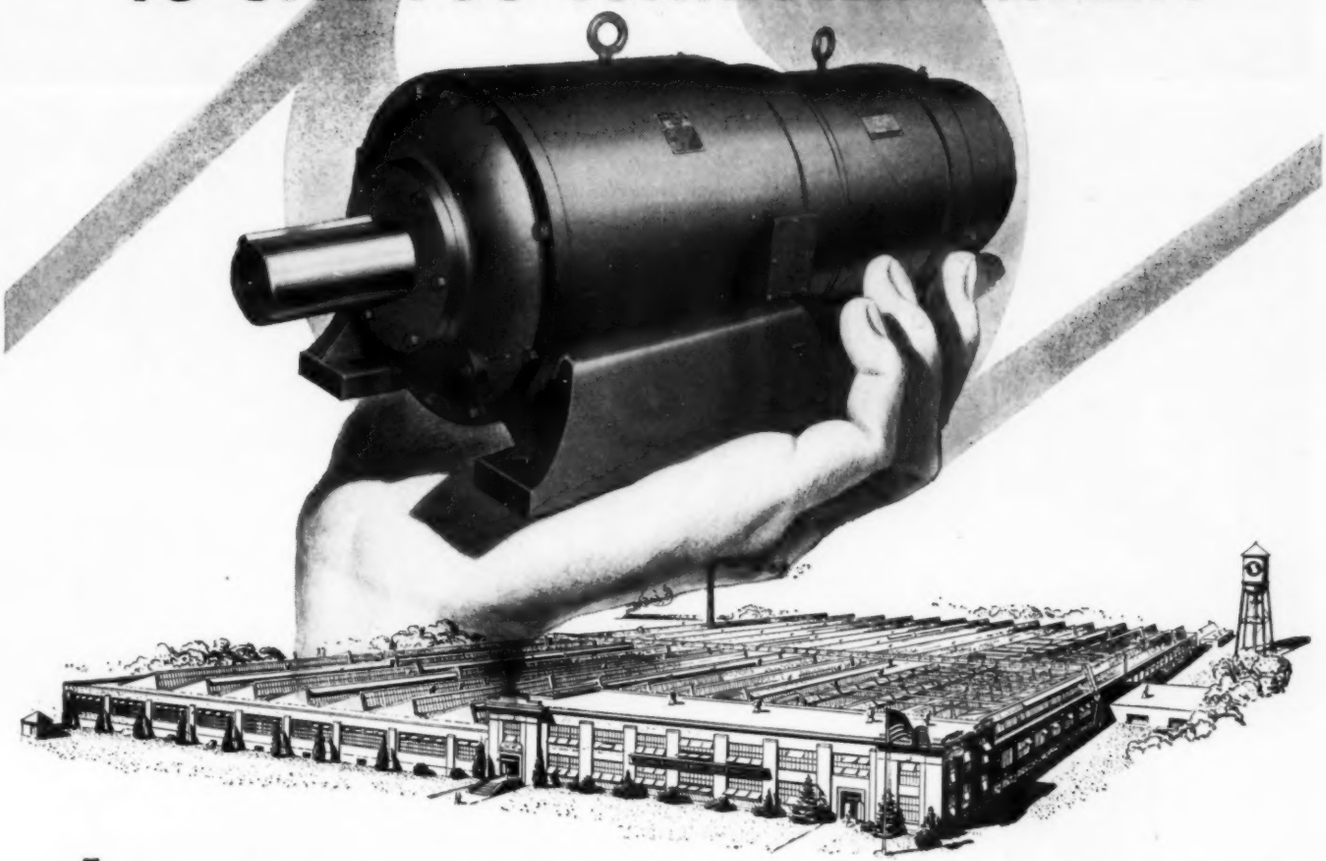

EVERY PART of a Star Gearmotor is perfectly suited to every other part . . . in design, dimension and quality. Motor, gears and all major components are made under the single exacting control of the Star plant.

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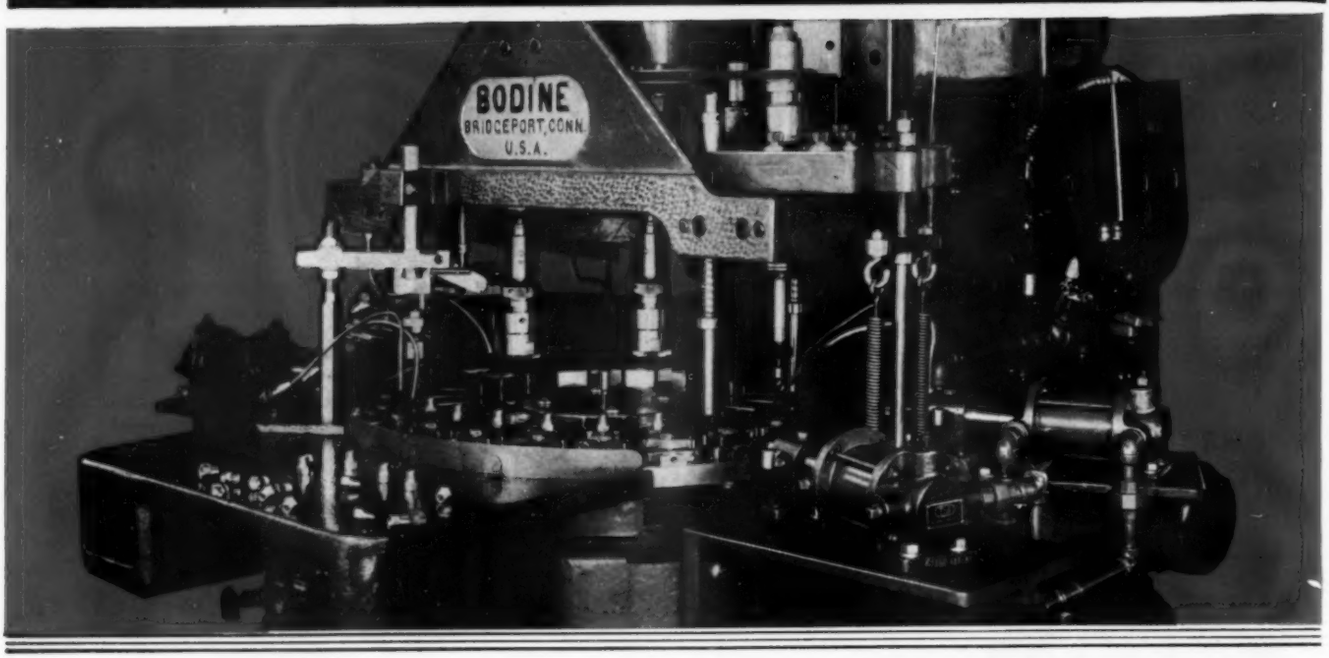

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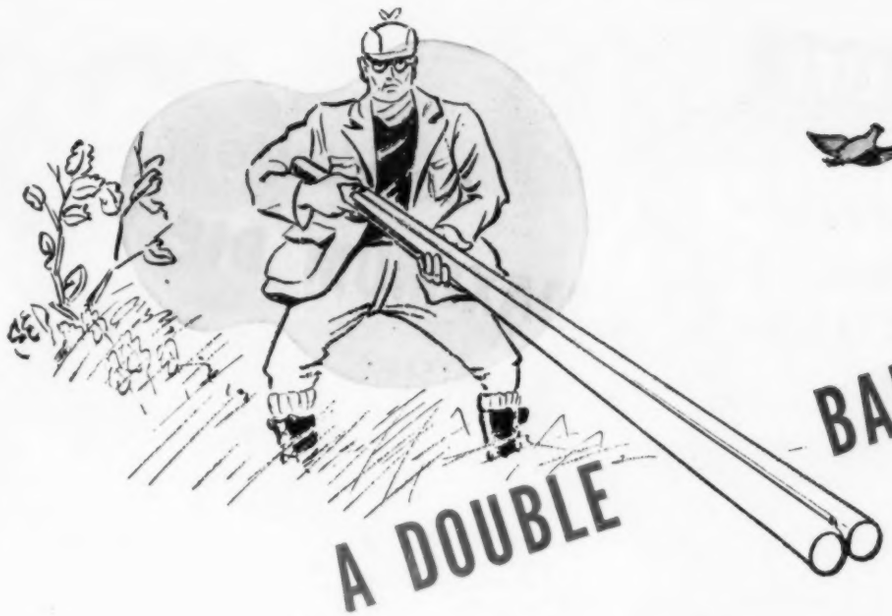
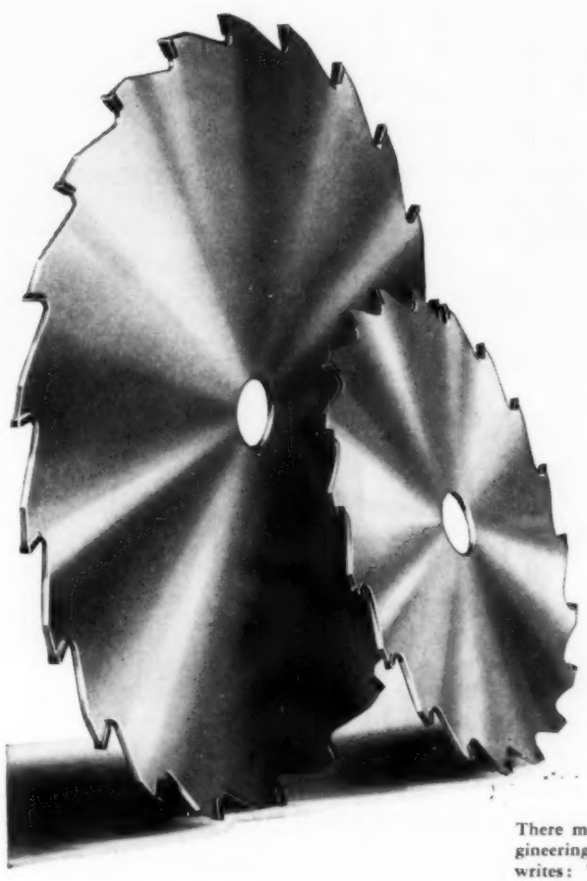


A DOUBLE BARRELLED JOB:

A Carbide-Tipped SAW THAT CUTS PLASTICS AND CUTS COSTS



Yes indeed . . . this MEYCO saw cuts plastic and other synthetic materials successfully. It is the result of more than a year's experience in solving tough cutting problems on special order for customers. This Carbide-Tipped saw has been engineered for its job: the blade, the teeth, the set are all designed for tungsten carbide, the hardest known satisfactory cutting material next to diamonds.

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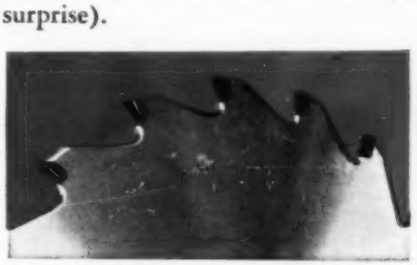
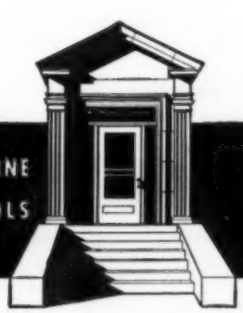
Write for full information and prices (which, incidentally, will come as a pleasant surprise).

There must be something to the engineering of this saw when one user writes: "More than 80,000 feet of plastic sheets have been cut and it looks good for as much again." Manufacturing fine cutting tools for well over half a century has given us the know-how to save you money on your cutting problems.





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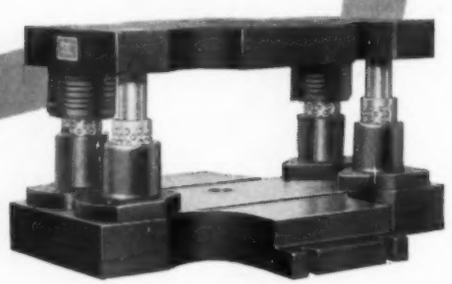

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These precision sets guarantee perfect alignment of punches and dies. Pre-loaded anti-friction bearings between leader pins and bushings never allow the slightest play; they prevent any lateral motion or tilting of the punch holder, so that punch and die engage squarely every time. Clearance between cut edges is maintained. Chipping of edges is eliminated. You obtain more production per grind and longer die life.

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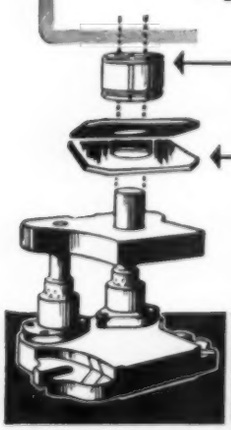

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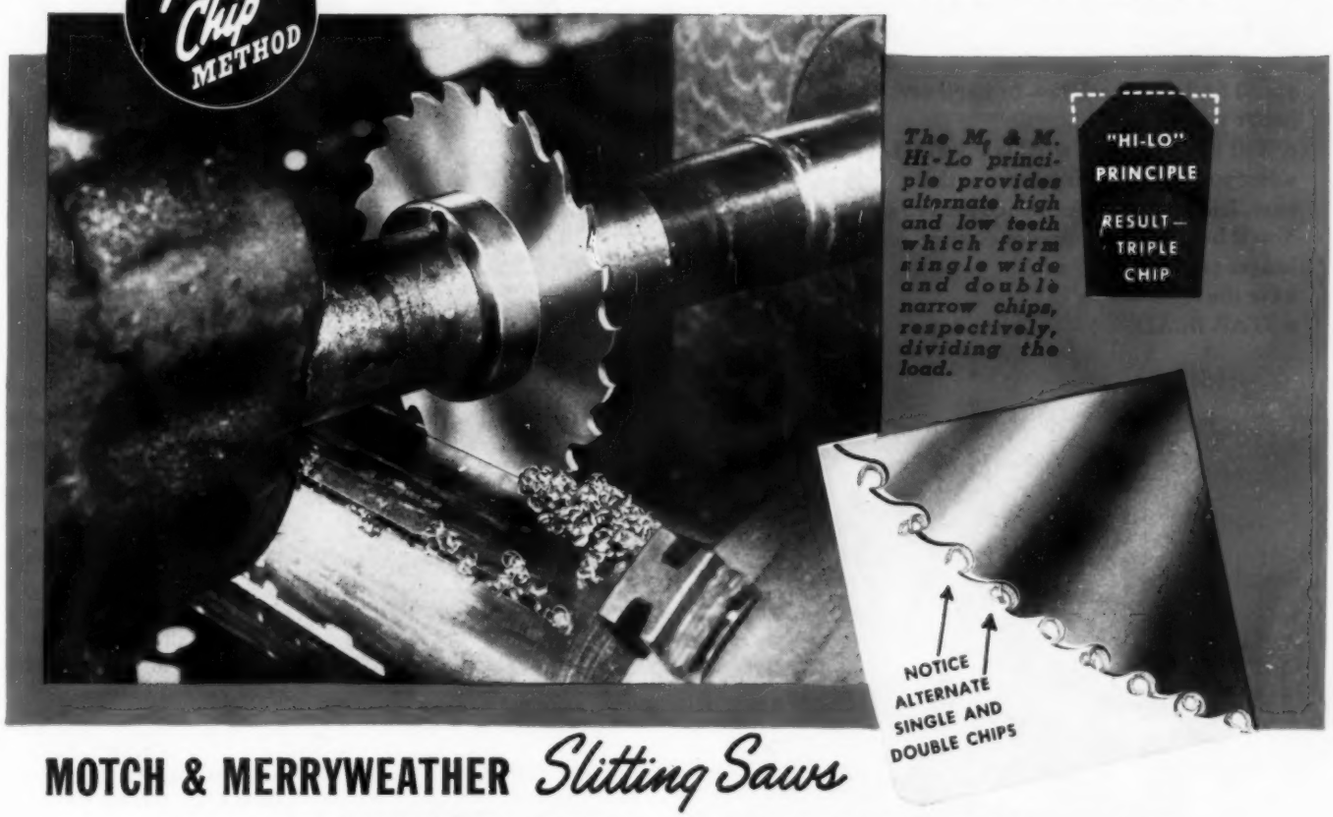
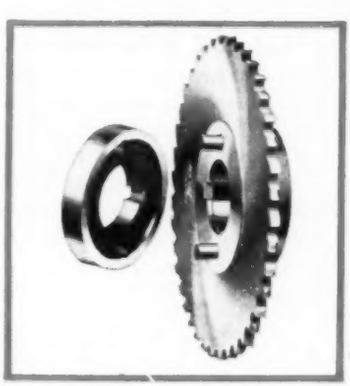

Triple-Chip METHOD
The M. & M. Hi-Lo principle provides alternate high and low teeth which form single wide and double narrow chips, respectively, dividing the load.
"HI-LO" PRINCIPLE
RESULT— TRIPLE CHIP
NOTICE ALTERNATE SINGLE AND DOUBLE CHIPS

MOTCH & MERRYWEATHER *Slitting Saws*

GIVE GREATER SPEEDS AND LONGER TOOL LIFE



Motch & Merryweather's original dual drive equalizes stresses, gives plenty of driving power, and makes blade keyways unnecessary

M. & M. Slitting Saw Blades enable you to profit from record-breaking speeds and satisfying accuracy. They give you all the well known advantages of the Triple-Chip Method. The characteristic M. & M. curved, cam-generated tooth contour avoids clogging, since the curling chips are self-clearing. A generous gullet imparts great strength to the teeth. Result: faster cutting, longer blade service.

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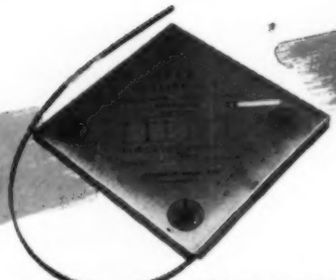

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STANDARD PIPE OR TUBING FROM STRIP STEEL!

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FOR LOWER COSTS and an adequate supply of pipe and tubing, roll your own on an A.E.F. Tube Mill! The capital investment and the operating cost are so comparatively low, any concern having an outlet for tubing or pipe from 15,000 to 45,000 feet per day can save enough money in less than one year's operation to return their original investment.

The Medium Wall Mill illustrated will produce both American Standard weight pipe, ½" through 2", and mechanical tubing up to 4" O.D. for such uses as: gas and fluid conveying lines; tubular parts for automobiles, trains, aircraft, farm machinery and industrial equipment; bicycle and furniture frames; electrical conduit; structural members for building, construction and industrial requirements, etc. Other models briefly described on the back of this page.

A.E.F. engineers will be glad to discuss fully the mechanics and economics of this equipment with you and are prepared to help you plan and make an A.E.F. Mill installation, put it into operation and train your operators.

Write for literature and information.

AMERICAN STANDARD WEIGHT PIPE ½" TO 2"

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MECHANICAL TUBING UP TO 4" O.D.
(maximum wall thickness .156")

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Perfectly formed, electrically welded, scarfed, sized, straightened and cut to length in one continuous, automatic operation at speeds up to 65 ft. per minute, depending on diameter size and wall thickness.

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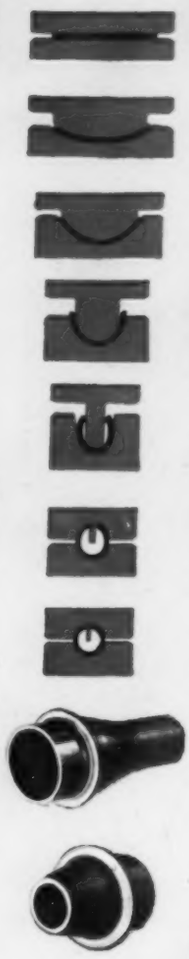
BRIEF FACTS...

7-STEP FORMING

The seven stages in forming flat strip into tubular form on an A.E.F. Medium Wall Mill are illustrated at the right. Four sets of side forming rolls are also furnished. Following the welding operation, finishing and sizing are accomplished by means of five additional sets of rolls—producing perfectly rounded pipe or tubing.



WORKABILITY

The finished pipe or tubing possesses the same strength and qualities as the original strip from which it is formed and the welded seam has a greater strength than the parent metal. It can be swaged, drawn, bent, upset, flanged or worked into special shapes without danger of fracture at the welded seam.

MEETS PIPE SPECIFICATIONS

Pipe produced on an A.E.F. Tube Mill will meet all pressure tests and specifications for electrically resistance welded American standard weight pipe.

COSTS LESS

Installation of an A.E.F. Mill represents a fraction of the investment necessary for comparable production of pipe or tubing by any other method.

BUILT IN THREE SIZES

1. 60 KVA Light Wall Mill produces tubing with wall thicknesses from .025" to .093" and outside diameters from ½" to 2½"; with slight modification at factory, limits can be extended to make tubing up to 3" O.D.

2. 170 KVA Medium Wall Mill produces American standard weight pipe from ½" to 2", as well as mechanical tubing up to 4" O.D. with maximum wall thickness of .156".

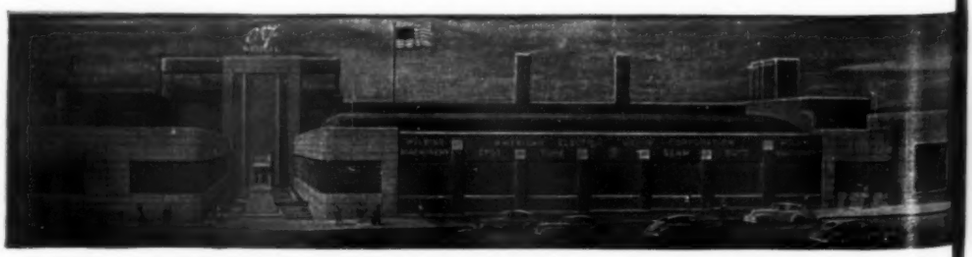
3. A.E.F. Heavy Wall Mill produces tubing up to 6" O.D. Detailed information on request.

DATA ON REQUEST

For complete data and literature on A.E.F. Tube Mills, submit information regarding the sizes and quantities of pipe and tubing required, and the uses for which it is intended.

Resistance Welding Machines

Modern A.E.F. Resistance Welding Machines, Tube, Spot, Seam, Butt Welders are built in a modern, completely air conditioned factory.



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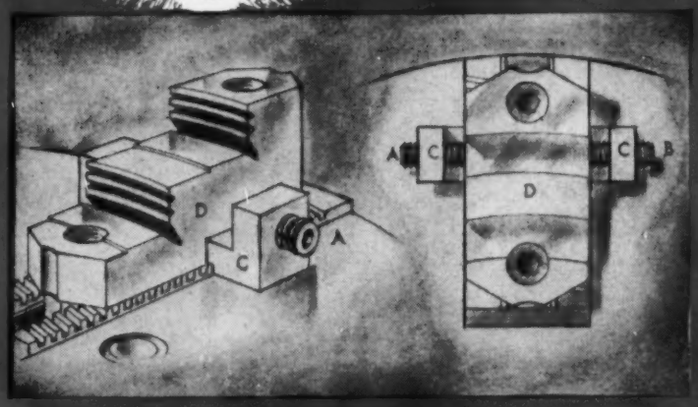
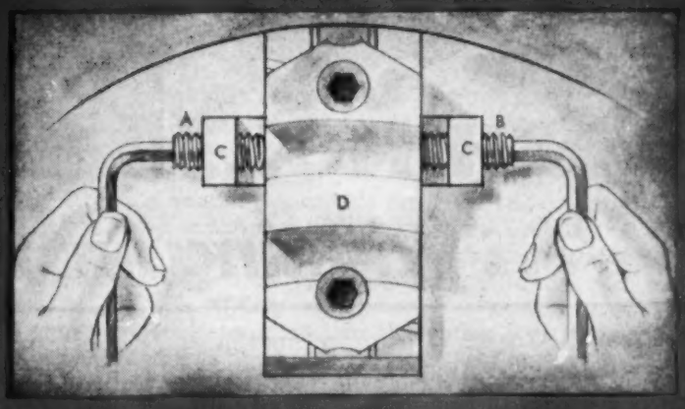
CUSHMAN "ACCRALOCK"



"Accralock" adjustments are obtained by loosening screw "A" and tightening screw "B," or vice versa, which causes key "C" to move to the right or to the left. This causes jaw "D" to move outward or inward under very precise control.



One full turn of the screws will move the jaw in or out .010". It is evident therefore, that accuracy of adjustment as close as .001" is easily possible. After adjustment has been made, tightening both screws positively locks the jaw in position.

PRECISE ★ POSITIVE ★ MINUTE SAVING

Power chuck jaw adjustment

One of the most important of recent developments in the chuck field.

1. Positive adjustment of top jaws to super-precision accuracy.
2. Simple and easy to manipulate.
3. Few parts, with little or no wear.
4. Assurance of positive rigidity and safety under heaviest loads.

A most important "plus" to the time and cost savings possible through the use of Cushman Power Chucks.

An exclusive feature of

CUSHMAN
SERRATED ADJUSTABLE JAW
POWER CHUCKS

Power chucking devices enable operators to do *better* work and *more* work with far less fatigue. Write for your copy of the new catalog PO-62 describing this equipment in detail.

THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONNECTICUT

BROACHING...

Turned roll pushed through broaching dies.

...winning in the stretch

From the coarse yarn to the fine finish rovings that make American textiles prominent is a matter of hundreds of fluted rolls. These fluted rolls give character and stretch to the yarn as they elongate the fibres passing through. It's mass production that demands close tolerance and a mirror-like finish. Any deviation from exacting specifications means poor rovings and poor cloth. Many textile manufacturers depend on Lapointe Push Broaching for supreme accuracy in the high finish of their fluted rolls. Lapointe engineers with a standard horizontal push broaching machine have designed a series of broaching dies so that the turned rolls are pushed through far quicker, cheaper and better than was previously possible.

If there is a metal removing problem in the manufacture of your product, consult Lapointe. Broaching perhaps can improve your product by greater precision, make it more economical by mass production.

Have you investigated Lapointe's Electrolized Broaches?

It is now standard practice to specify them where tool life and a minimum of galling is a desirable premium. Write today for descriptive information.

THE Lapointe

HUDSON LAPOINTE MASS.

MACHINE TOOL COMPANY

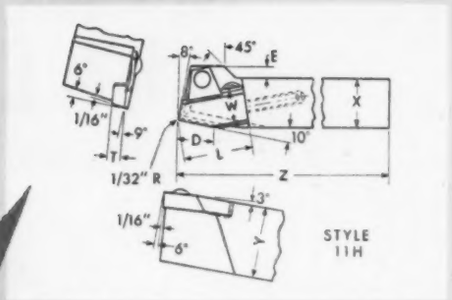
HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory • Edgware • Middlesex • England

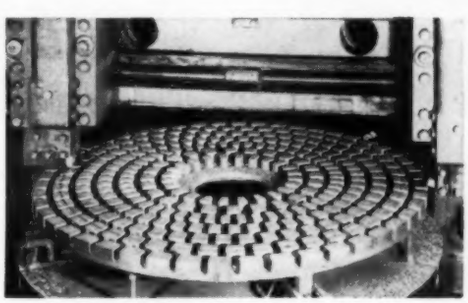
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

IF Interrupted Cuts Are Your Problem

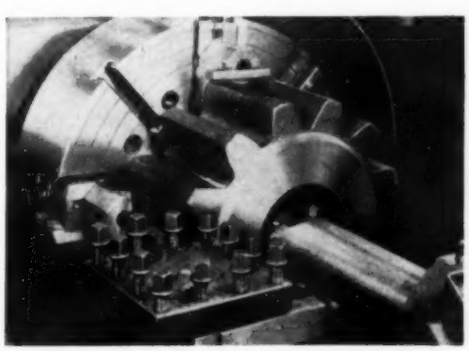
Learn About Kennametal



Style 11H is one of a complete line of Kennametal tools, having sturdy, clamped-in, advanceable Kennametal tips. This assembly—developed by Kennametal—is highly successful on interrupted cutting, and is equally outstanding on continuous-cut operations. It utilizes Kennametal's high strength to best advantage—provides a thermally-strain-free assembly; makes possible deep cuts and heavy feeds; simplifies grinding since tip is advanced and re-sharpened without removing any steel from shank; and enables practically all of the Kennametal tip to be utilized for cutting.



This iron casting has 288 chilled lump interruptions. A Kennametal standard Style 11T80 tool faces and turns it at 190 ft./min., .048" feed, and ¼" depth of cut.



Kennametal bores, turns, and faces over interruptions and sand holes on this chrome-nickel steel rack pinion. Speed—155 ft./min.; feed—.032"; depth of cut—¼" to 5/16". Performance is 5 to 1 over high speed steel tools in production and pieces per grind.

You're probably enjoying the advantages of carbide tooling on continuous-cut operations—but how about interrupted cutting?

Has this given you tool trouble, and made you resort to slower machining methods on some important jobs?

If so, Kennametal will help you solve this problem. Its ability to withstand the shock of interrupted cuts, on both cast iron and steel, has been unequalled.*

Although cutting conditions are often improved by changing the tool shape so that the shock will be imposed on a section of the tip that is stronger and better supported, it is still the carbide that must take the punishment. Here's where Kennametal has a distinct advantage.

Because of exclusive processing methods and careful control in manufacture Kennametal's impact strength is unusually high for such a hard material—as great as that of hardened alloy steels having much lower hardness and compressive strength.

Still further advantages for interrupted cutting are obtained by the use of mechanically-held tools developed by Kennametal Inc. Tips of characteristically high impact strength are securely clamped to, and firmly supported by a heat-treated steel shank, to provide an exceptionally strong strain-free assembly.

If you have had difficulty with carbide tools on interrupted cuts, let us engineer Kennametal to the solution of your particular problem.

**Ask us to send you a set of Performance Reports that demonstrate the superior results obtained with Kennametal Tools on interrupted cutting.*

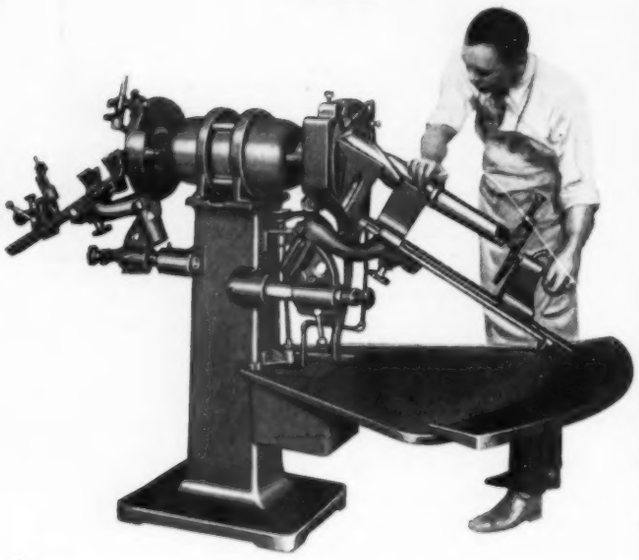
KENNAMETAL Inc.

LATROBE, PA.

Trade Mark Reg. U. S. Pat. Off.

MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES AND CUTTING TOOLS THAT INCREASE PRODUCTION

Lower DRILL CONDITIONING COSTS WITH A YANKEE TWIST DRILL GRINDER



A properly ground drill cuts fast, drills straight, accurately sized holes with less pressure. Accurately sized holes mean reduced reamer costs and less tap breakage.

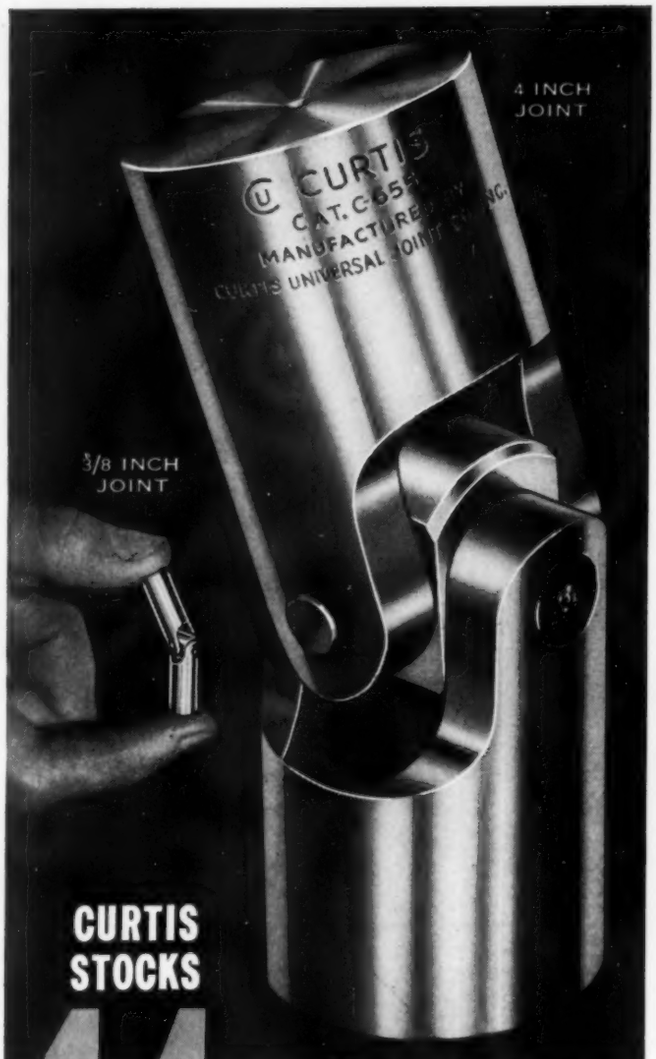
With Yankee ground drills, the lips are of equal length, with proper clearance for the material being drilled.

You do not need an experienced machinist to operate the Yankee. Any of your tool-room men with a little instruction can grind all drills, large or small, quickly and accurately. Uniform pressure control prevents burning. With the Yankee the operator can change from one size drill to another with a minimum of time loss. Quick set-up has long been a money saving feature of the Yankee Drill Grinder. Assure yourself of a constant reserve of properly ground drills.

- ★ Single or double end.
- ★ Wet grinding attachment available.
- ★ Floor or bench models optional.
- ★ Sharpens drills up to 4".

Write us for the name of nearest dealer.
Ask for your copy of Bulletin A-48.

COVEL MANUFACTURING COMPANY
BENTON HARBOR MICHIGAN U.S.A.



CURTIS STOCKS

14 STANDARD SIZES OF UNIVERSAL JOINTS
FROM 4" TO 3/8" DIAMETER

offering modern industry a real advantage in having universal joints, of the highest quality, available for immediate shipment.

This wide range of sizes — with either solid or bored hubs — fits most universal joint needs — from instrument controls to heavy duty steel mill applications.

Curtis makes universal joints exclusively and their 25 years experience is yours to command. Special machining for specific applications is done before assembly — saving money and insuring accuracy.

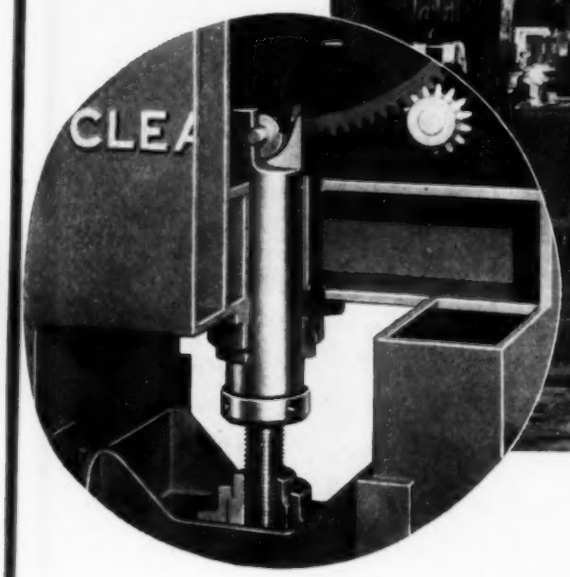
Send us your universal joint problems, indicating speed, angle of operation and torque load, with blueprints if possible. There is a Curtis Universal Joint immediately available to you — whether for a heavy duty 4" installation or a high-speed light duty job.

WRITE DEPT. B-3

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD MASS.

CMC CLEARING

Cutaway illustration shows bronze bushed crown guiding of the Clearing slide, which, added to conventional gibs, gives extra assurance of precise movement which cuts die wear, and delivers parts to closer tolerances.



CLEARING PRESSES AT KAISER-FRAZER

Big Willow Run Plant is Equipped for Long Run Production with Maximum Economy

When Kaiser-Frazer took over the former Ford bomber plant at Willow Run, Michigan, and tooled up for mass production of motor cars, Clearing presses were chosen to carry the major load of body shop operations. The automobile concern's phenomenal production of 150,000 cars in the first year is well known to the public and Clearing helped to make it possible by expeditious delivery of the Clearing presses that are operating there now.

Long die life, with less down time for die repair and adjustment, results from the double-guided slides and multiple suspension which feature Clearing design. Kaiser-Frazer engineers were seeking to hold production costs to the minimum, and they selected Clearing presses because they wanted to avoid operating interruptions that send costs skyward. Furthermore, the well known precision of Clearing machines assures delivery of parts which will assemble smoothly, quickly and easily.

Production economy has always been important. Today it is becoming a vital factor in the struggle for competitive survival which is already visible in some lines and inevitable in all. Now is the time to see how Clearing can help you lower *your* costs. It costs you nothing to ask us for details.

CLEARING MACHINE CORPORATION • 6499 W. 65th St., Chicago 38, Ill.

CLEARING THE WAY TO EFFICIENT MASS PRODUCTION

CMC CLEARING

CURRENT DELIVERY* ON A HYSTER FORK-TYPE LIFT TRUCK, STRADDLE TRUCK OR KARRY KRANE

Hyster "20"

NOW you can get what you've NEEDED SO LONG. Expanded Hyster factory facilities make CURRENT DELIVERY possible.

GO TO YOUR HYSTER DISTRIBUTOR FOR CURRENT DELIVERY

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Hyster "75"

Hyster "150"

Hyster Karry Krane

Hyster Straddle Truck

7 HYSTER TRUCKS—ALL ON PNEUMATIC TIRES

HYSTER "20" FORK TYPE.....	2,000 lbs. Capacity
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HYSTER "75" FORK TYPE.....	7,500 lbs. Capacity
HYSTER "150" FORK TYPE.....	15,000 lbs. Capacity
HYSTER KARRY KRANE.....	10,000 lbs. Capacity
HYSTER "M" STRADDLE TRUCK....	12,000 lbs. Capacity
HYSTER "MH" STRADDLE TRUCK...	30,000 lbs. Capacity

Hyster Parts and Service Everywhere—See Your Nearest Distributor for Materials Handling Advice—for Catalogs.

*In a few restricted areas certain Hyster models are not immediately available due to heavy demands by certain industries, but increased Hyster production will soon relieve this situation.

HYSTER "20"—2,000 lb. capacity. Only 37" wide. Ideal for work in narrow aisled factories, warehouses and in box cars.

HYSTER COMPANY

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VICKERS CUSTOM BUILT
HYDRAULIC POWER UNITS

Consolidate and Simplify your Hydraulic System into

ONE COMPLETE UNIT

These Units are individually designed for each job to include all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., and all needed hydraulic accessories (oil filters, air cleaners, oil level gauges, etc.) in one self-contained and compact package. Hydraulic connections to the machine are grouped in a conveniently located manifold.

Hydraulic design is simplified immeasurably. A complex circuit is delivered in a "package" ready to attach and operate. Savings in installation and maintenance costs alone make the unit well worth while. Another important advantage is the sole responsibility of Vickers Inc. for the complete hydraulic actuating circuit. Every Unit has the benefit of experienced assembly and is pretested at the factory so that it is ready for immediate operation.

Ask for Bulletin 47-45 describing the many advantages of Vickers Custom-Built Hydraulic Power Units.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1410 OAKMAN BOULEVARD • DETROIT 32, MICHIGAN

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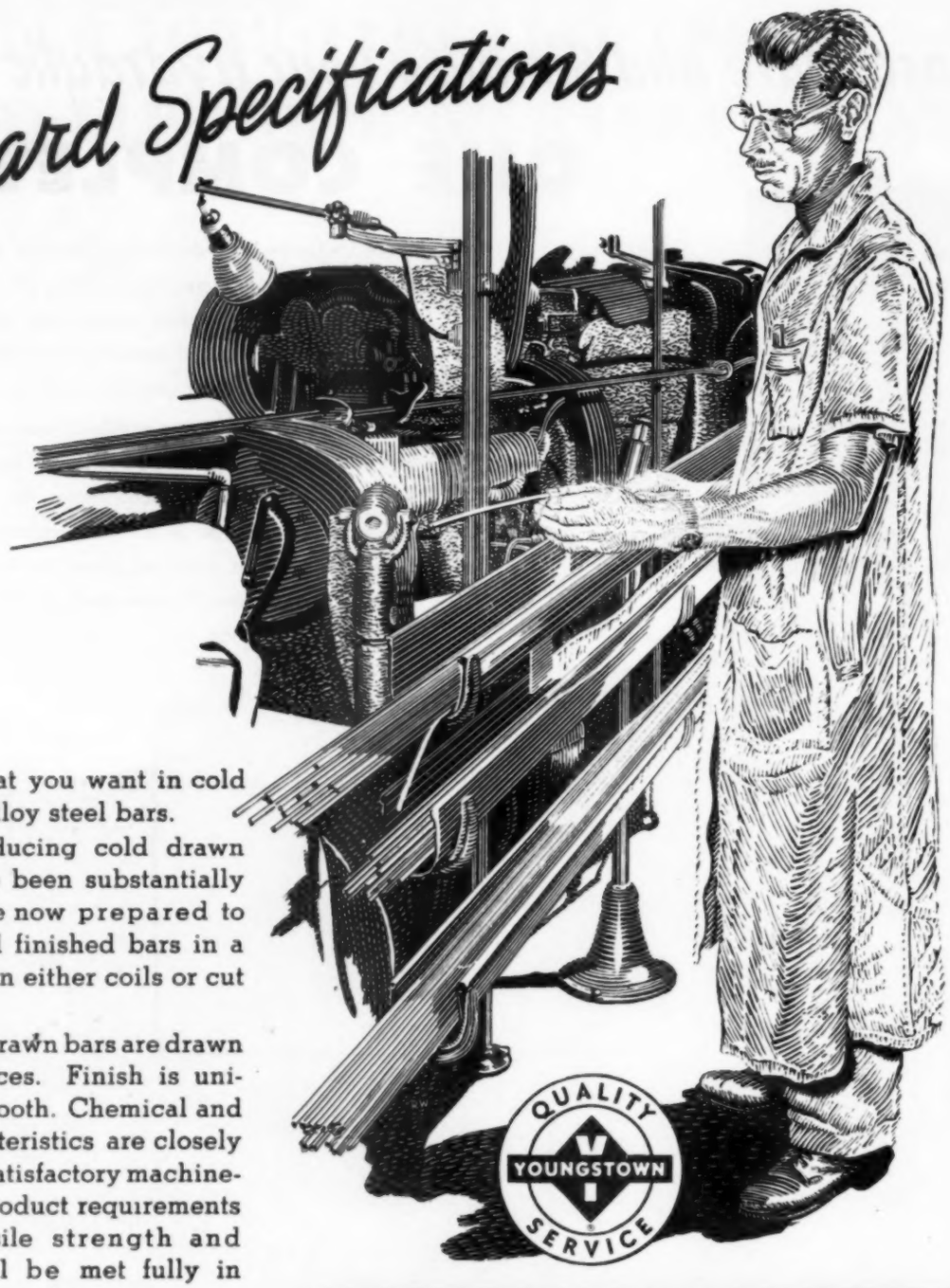
3320

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 192

Cold finished carbon and alloy steel bars to meet

Standard Specifications



TELL us what you want in cold finished carbon or alloy steel bars.

Facilities for producing cold drawn bars at our mill have been substantially expanded. We are now prepared to supply users of cold finished bars in a wide range of sizes, in either coils or cut lengths.

Youngstown cold drawn bars are drawn to precision tolerances. Finish is uniformly bright and smooth. Chemical and metallurgical characteristics are closely controlled to insure satisfactory machineability. Your own product requirements as to ductility, tensile strength and yield strength will be met fully in Youngstown cold drawn bars.

Get in touch immediately with the nearest Youngstown district sales office. Our representative will call on you promptly, to discuss your requirements and make every effort to serve you to your satisfaction.

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THE YOUNGSTOWN SHEET AND TUBE COMPANY

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Manufacturers of

CARBON · ALLOY AND YOLOY STEELS

Cold Finished Carbon and Alloy Bars · Bars · Rods · Wire · Sheets · Plates · Pipe and Tubular Products · Conduit · Electrolytic Tin Plate · Coke Tin Plate · Tie Plates and Spikes.

Be sure THAT YOU GET *genuine*

CLECO HOSE FITTINGS AND ACCESSORIES

These products are leaders in the industry and have gained world wide acceptance in every place where compressed air is used. For safety, economy and durability use Cleco Couplings.

They can be obtained *only* through The Cleco Division of the Reed Roller Bit Company or their licensed agents.

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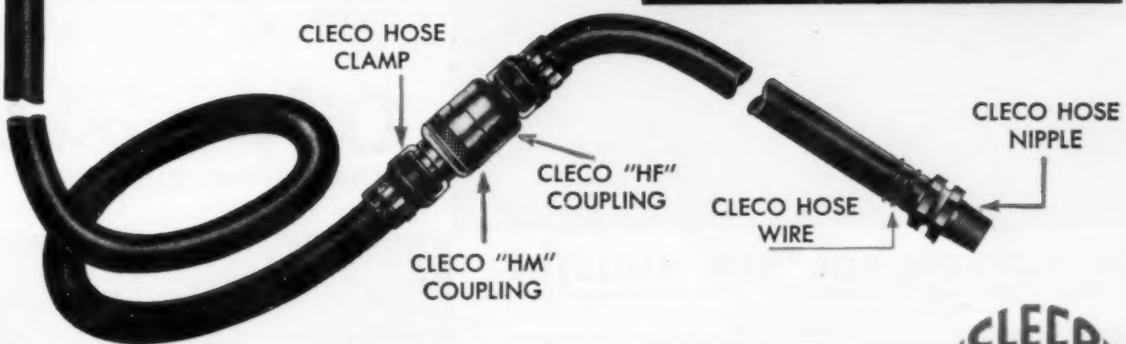

CLECO AIR TOOLS — CLECO ACCESSORIES

CLECO DIVISION

of the REED ROLLER BIT COMPANY, P. O. Box 2119, Houston, Texas, U.S.A.

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GEAR NEW VERTICAL CYCLEMATIC BROACHING MACHINES . . .

Holes broached in valve rocker arms 1200 per hour

17 splines broached in universal joint yokes 500 yokes per hour

Work loaded during broaching stroke.
Automatically positioned, threaded, broached, and ejected.

The *unique* Oilgear Vertical Cyclematic Broaching Machine is a *high production* unit. Typically, it finish-broaches 17 splines in universal joint yokes at the rate of 500 pieces per hour, using 3 tools; it finish-broaches holes in valve rocker arms at an average rate of 1200 pieces per hour, using 6 tools. These valve rocker arms are loaded during the broaching stroke.

Work is loaded at a convenient level. Positioning, threading, broaching and ejecting work are entirely automatic. The usual operations, pilot and control valves and other parts that confuse and tire the operator are eliminated. Full manual control of the cycle is provided for test and set-up purposes.

Work table and all controls are designed for utmost ease and convenience to the machine attendant. Dual safety start button, emergency stop button, cycle selector and tool positioning controls are all located in easy reach. Famous Oilgear two-way variable displacement pumps provide variable broaching speeds up to 30 f.p.m. and independently variable return speeds up to 80 f.p.m.

Full pressure lubrication of work and tools is continuous and automatic during the broaching operation and forces chips to fall away immediately. Tools are rigidly secured at both ends during the critical portion of the stroke, eliminating vibration and minimizing drift.

The Cyclematic sets on its own base and requires no special foundation or pit. It can be made a part of a production line without costly preparations and without disrupting operations. Work table height conforms to usual conveyor working level. THE OILGEAR COMPANY, 1313 W. Bruce Street, Milwaukee 4, Wisconsin.

Oilgear Fluid Power
BROACHING MACHINES

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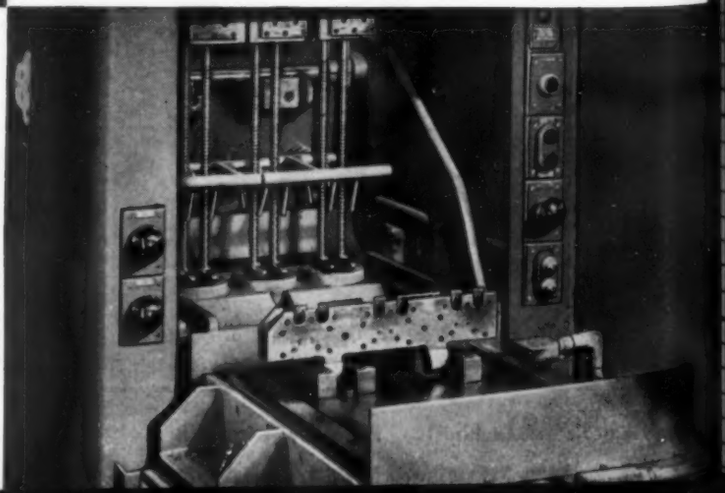
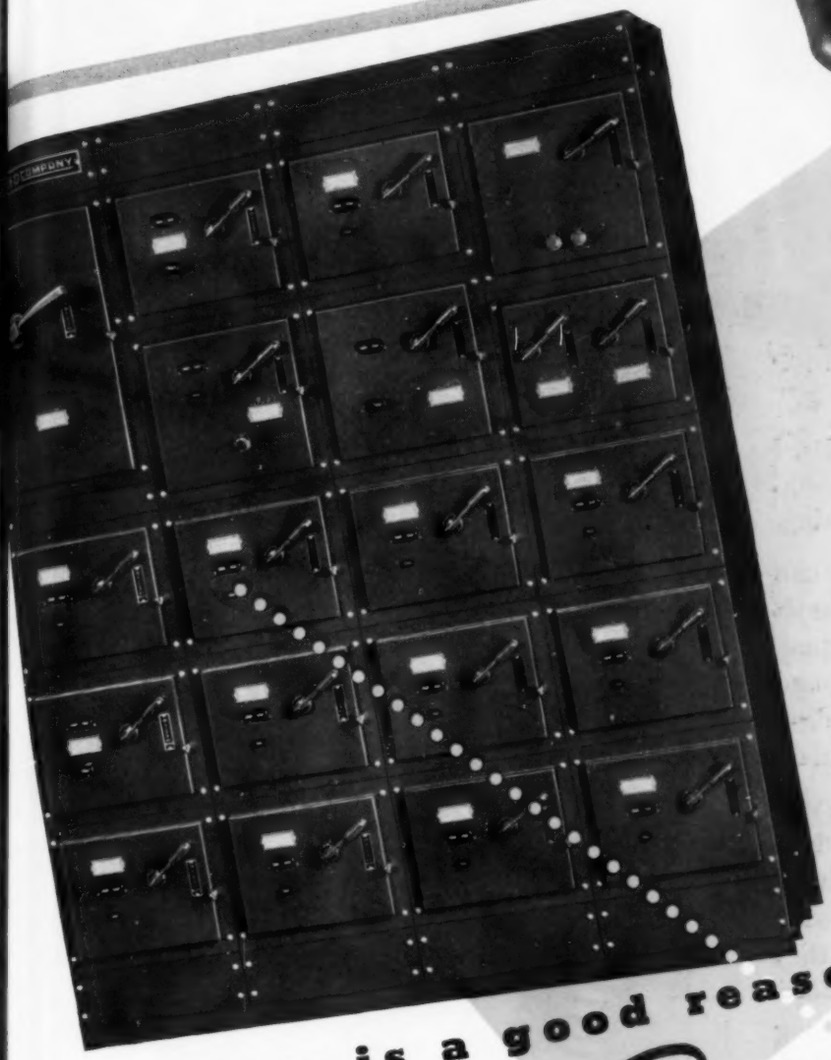
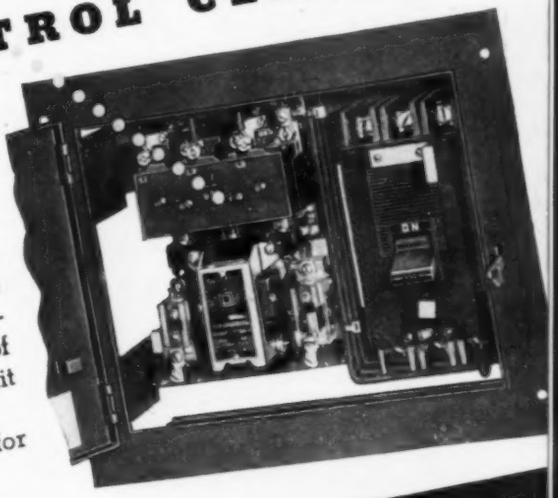




PART OF THE PARADE OF NEW DESIGNS

Here is a good reason for specifying Square D CONTROL CENTERS



• Control centers permit low-cost grouping of starters in favorable locations. They offer the basic advantages of attractive appearance, compactness, easy installation, convenient maintenance and adaptability to future change or expansion.

You get better performance in Square D Control centers because each of the basic advantages is greatly increased by the time-proved design and operation of Square D Starters plus the inherent value of Circuit Breaker protection.

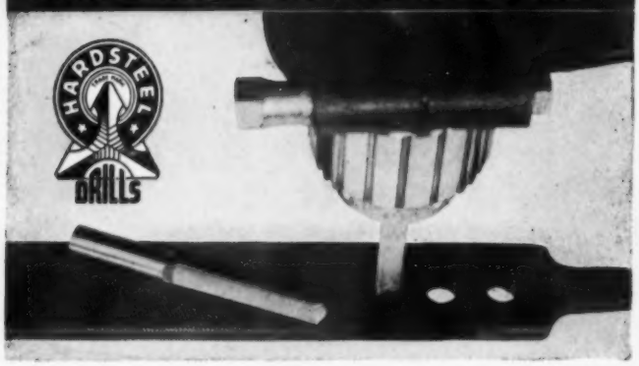
Call your nearby Square D Field Engineer for complete details.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D CANADA, LTD., TORONTO, ONTARIO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Drill Hardened Steels *without Annealing* with "HARDSTEEL"



Don't let anyone tell you that hardened steels must be annealed before drilling, countersinking, counterboring or reaming.

With "HARDSTEEL" drills you can produce accurate, smooth holes in steels hardened by any process — oil-hardened, water hardened, cyanided, nitrided, and they work equally well on work-hardening steels, and high carbon-high chrome steels of any degree of hardness.

"HARDSTEEL" drills used with standard drill presses cut costs in production shops because parts drilled after hardening always match at assembly. In service shops they save time and material and permit engineering changes calling for additional drilling to be made after parts are full hardened.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are now functioning in thousands of plants in parts recovery operations.

You Harden It — We'll Drill It — with "HARDSTEEL"

"HARDSTEEL" Tool bits make faster, deeper cuts on steels and non-ferrous alloys.

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1388 East 222nd Street
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"HARDSTEEL"
DRILLS • TOOL BITS • SPECIALS

ALLEN STAINLESS STEEL

HEX-SOCKET SET SCREWS • SOCKET HEAD CAP SCREWS

NON-CORRODING "ALLENS" for applications where steel is subject to excessive moisture, chemical fumes or corrosive vapors. Made of "18-8 Type" *Stainless,* non-heat treated, non-magnetic. Set screws: stock sizes #6 to ½" diameter; cap screws: #8 to ½". N. C. threads only. Class 3 fit; Allen precision fastenings. . . Order of your local Allen Distributor, or write us for samples and literature.

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INTRODUCING THE *New* HYDROPTIC "7"

MADE BY SIP GENEVA

WORLD FAMOUS HYDROPTIC ACCURACY WITHIN .0002"

Built to meet the increased demands by American manufacturers for a precision Jig Boring and Milling Machine of larger capacity, the SIP HYDROPTIC "7" embodies all the unique features of the famed HYDROPTIC-B. In addition, larger table dimensions, a wide range of speeds and feeds, and rigid construction throughout raise productive capacity to the highest ever achieved We will be pleased to have one of our engineers discuss the SIP HYDROPTIC "7" with you.

CONDENSED SPECIFICATIONS

Table working surface 61" x 40"
Hydraulic table feeds up to 12 in. min.
Drilling capacity in cast iron $2\frac{3}{8}$"
Boring capacity 10"
SIP built-in microscopic measuring system, free from wear and mechanical stress, assures accuracy for all settings of work table and spindle head within .0002"
Also — the HYDROPTIC "8", with same table and spindle head, plus a horizontal spindle head which permits jig boring and milling in three coordinates.

COSA CORPORATION CHRYSLER BUILDING NEW YORK 17, N. Y.

Six Workers + E-M Foresight = Five Heroes

Employers Mutuals Job Safety Training seemed "dull stuff" until the moment of tense drama came . . .

All six men of the power-line crew had received Employers Mutuals safety training... wondered whether such "dull routine stuff" was necessary, until one day—

A severe electric shock hurtled one of their number from a pole, his clothing aflame. His five mates, ready for such emergency, quickly beat out the flames, loosened his clothing, induced artificial respiration, had him well on the way to recovery within a half hour.

Each received a gold watch from Employers Mutuals in recognition of his part in saving a fellow worker's life.

Throughout industry, in every type of business, thousands of men and women are taught such life-saving practices, trained how to act in an emergency by Employers Mutuals engineers and industrial nurses.

Skill in accident prevention, control of industrial health hazards, development of first aid programs . . . all are accomplished with a tactful, human approach that builds good will and makes Employers Mutuals services unique in the insurance field.

Employers Mutuals write: Workmen's Compensation—Public Liability—Automobile—Group Health and Accident—Burglary—Plate Glass—Fidelity Bonds—and other casualty insurance. Fire—Extended Coverage—Inland Marine—and allied lines. All policies are nonassessable.

Employers Mutuals Policies Protect Lives, Health and Property

Your plant accident experience materially affects the cost of your workmen's compensation insurance. Send for Employers Mutuals' booklet, "Safety Engineering." It explains the importance of such facilities and experience in keeping your accidents under control. Also be sure to have our "Dictionary of Insurance Terms." It will help you to understand the provisions of your policies. Send for these valuable, informative booklets on your letterhead—or call your local Employers Mutuals man.

EMPLOYERS MUTUALS OF WAUSAU

. . . make insurance understandable

EMPLOYERS MUTUALS OF WAUSAU

EMPLOYERS MUTUAL LIABILITY INSURANCE COMPANY OF WISCONSIN

EMPLOYERS MUTUAL FIRE INSURANCE COMPANY

HOME OFFICE: WAUSAU, WISCONSIN

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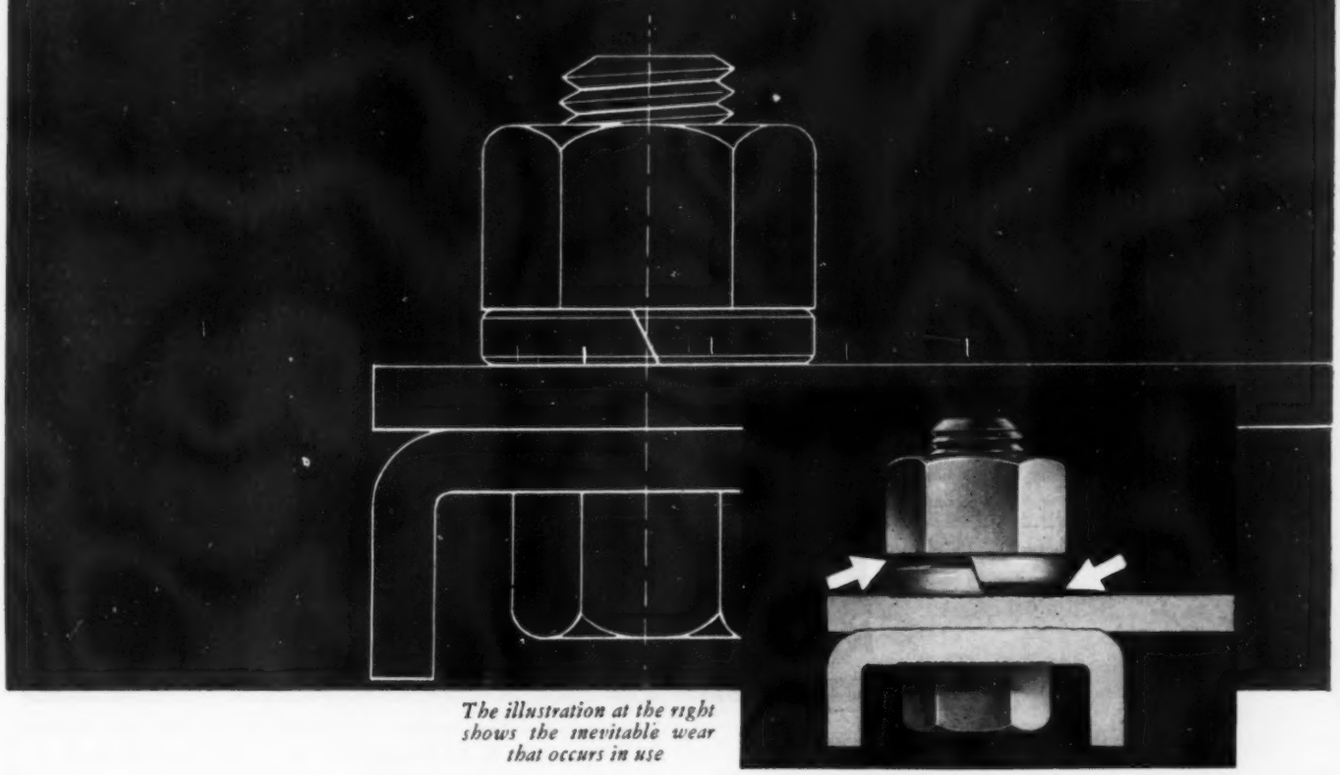
To Draftsmen, Engineers and Designers



The illustration at the right shows the inevitable wear that occurs in use

Fundamentals are important, this is fundamental.

Many devices can lock a nut on a bolt so the nut **cannot** turn. But that alone is not sufficient.

Many constructions – so bolted – will loosen because of bolt stretch, and the frictional wear of metal on metal, burrs, flares, and the pulverizing of paint, scale and rust.

Since the advent of the castellated nut, research has found that looseness is usually caused by ductility, and wear at every contact point of metal surfaces.

From an engineering point of view, nut **locking** devices – although they may keep the nut from turning – do not and cannot give the necessary spring reaction that keeps bolted assemblies tight. **Vibration** and **stress loosen everything** – they always have and always will.

You **must** use a spring which expands as wear occurs. Expanding **spring** power retards initial wear, then compensates for later wear, and **holds parts tight** for a **long period** of time. **A strong spring does it – nothing else can.**

So **with** or **without** a nut locking device specify spring washers on every bolted construction you design.

The **live spring** gives you safety, economy, and efficiency.

Kantlink spring washers are strong, nontangling, helical springs with wide and ample reactive power – (spring expansion).

There is no substitute as economical. No fixed nut nor any other type or design of washer can possibly equal the great holding power of a **long range live spring** – a big helical spring such as Kantlink.

Write today for a descriptive folder.

Originators of KANTLINK the long-range spring washer

THE NATIONAL LOCK WASHER COMPANY

Newark 5, New Jersey **Milwaukee 2, Wisconsin**

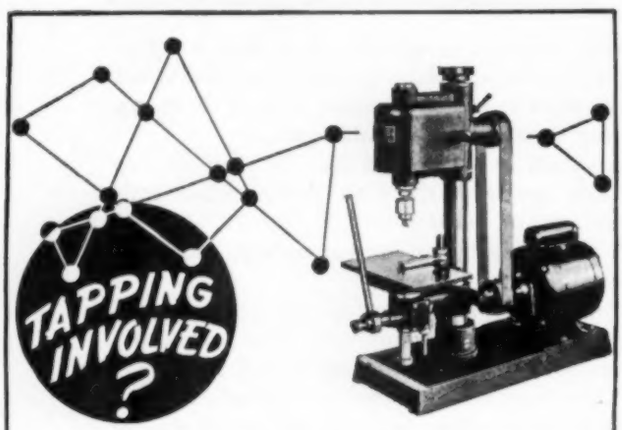
Goss & De Leeuw

THE WORLD'S FINEST MULTIPLE SPINDLE

Chucking Machines

GOSS & DE LEEUW MACHINE CO.

Kensington, Conn.



Small hole tapping (from the smallest and finest tap to 10-32 inclusive) need not be involved. With the Hamilton Super Sensitive Tapping Machine small hole tapping becomes routine. "Fool proof" in operation, the newest employee can become expert during the first day.

Patented power transmission and adjustable stops permit tapping of blind holes to the very bottom without tap breakage. Spindle idles in reverse while tap is being centered. Pressure to hand feed lever changes spindle rotation and engages tap. Release of pressure reverses and withdraws tap.

Get complete details and specifications. Write today for our Bulletin T-47.

THE *Hamilton* TOOL COMPANY

830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

The RANDALL & STICKNEY Platform Gauge

. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".
Dial graduated 0 to 50 in thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.
Base 8" square; height 13"; weight 18½ lbs.

Investigate Now!

FRANK E. RANDALL CO.
248 Ash Street
Waltham 54, Mass.

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60 YEARS MANUFACTURING

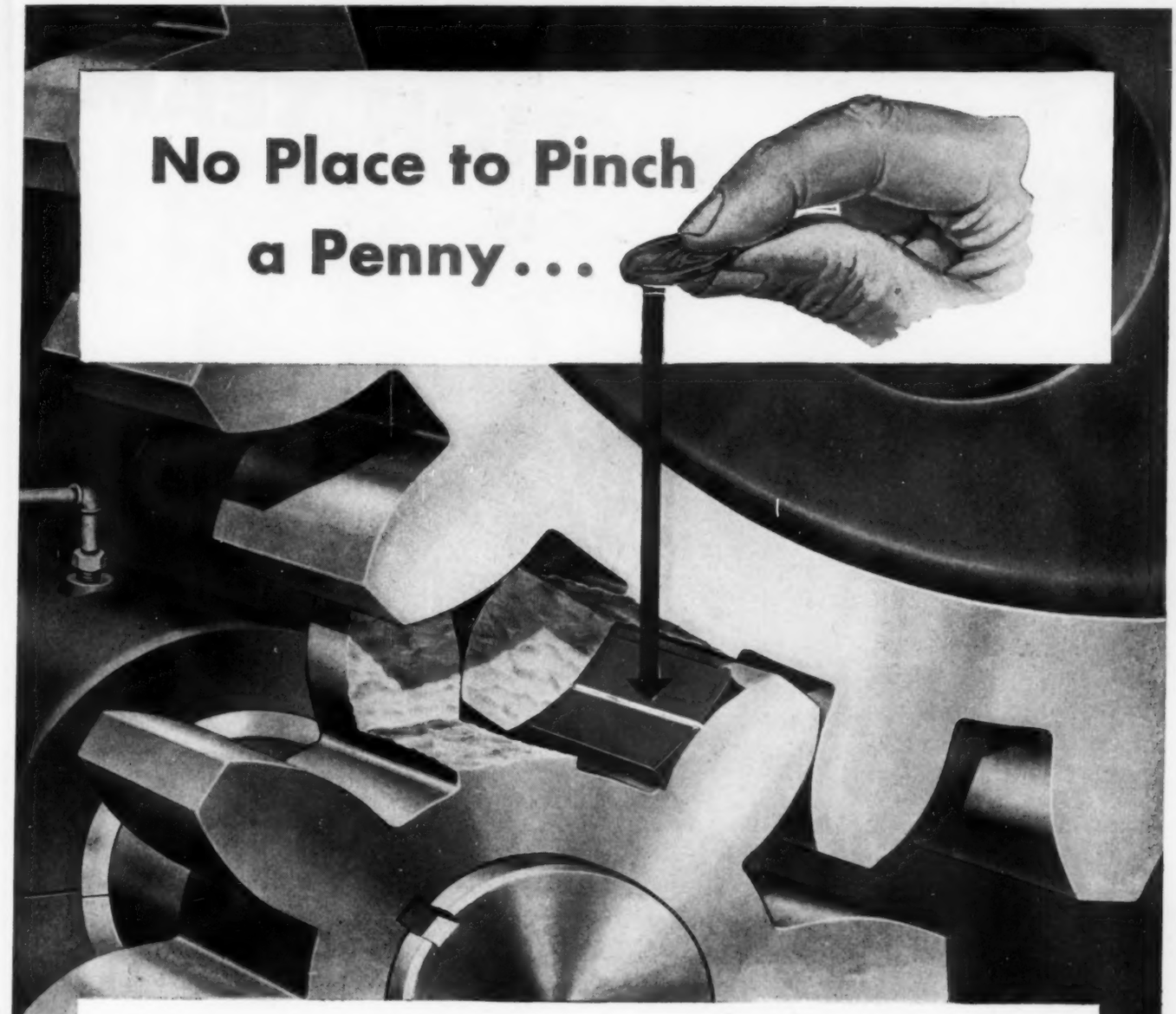
Multiple Spindle Drilling and Tapping Machines — Automatic Drilling and Tapping Units — Multiple Spindle Attachable Drill Heads—Hot and Cold Swaging Machines—Hammering Machines — Tools, Jigs & Fixtures — Contract Work — Special Machinery

LANGELIER MANUFACTURING COMPANY,
PROVIDENCE 7, RHODE ISLAND

BAUMBACH *The* DIE SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

T. A. BAUMBACH MFG. CO., 1804 S. Kilbourn Ave., Chicago 23, Ill.



The right oil here saves far more than it costs!

You're looking at a danger spot in industry —the spot where two gear teeth come together. That white line shows the contact area where pressures build up, sometimes to thousands of pounds per square inch.

This is no place to pinch pennies on lubrication. The right oil or grease here resists high pressures, protects gears against metal-to-metal contact and failure. The cost is negligible, compared to the many benefits obtained.

Socony-Vacuum brings 82 years' lubrication experience into your plant to help solve your gear problems.

Our Correct Lubrication program assures maximum protection for every type of gear—and all other vital machine parts. Get this program for less "toothaches" and headaches on production.

Socony-Vacuum

Correct Lubrication

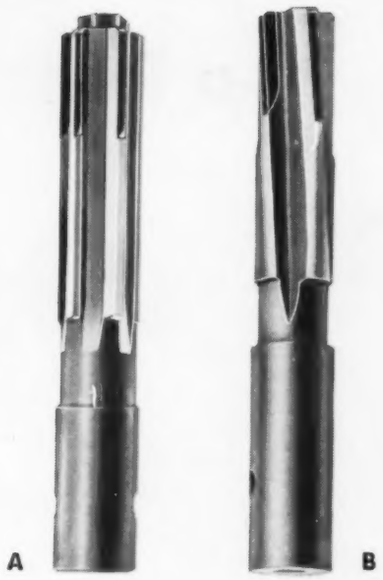
SOCONY-VACUUM GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

TOP PRODUCTION TEAM

for HIGH Accuracy and LONG Runs

AUTOMATIC SCREW MACHINES ..... PLUS ..... **Staples CARBOLOY-TIPPED** CEMENTED CARBIDES **STUB SCREW MACHINE REAMERS**



(A) Staples Carboloy - tipped Expansion Stub Screw Machine Reamer.

Staples patented expansion principle permits easy adjustment of tool to .0001". Expansion plug limited to $^{3}/_{32}$" extension beyond tool end (width of cut-off blade) eliminates possibility of plug striking bottom of drilled hole. Can also be furnished with plug flush with tool end if specified.

(B) Staples Carboloy - tipped Solid Stub Screw Machine Reamer.

Staples stub screw machine reamers cut production costs on automatic screw machine operations by eliminating frequent down time for reamer sharpening. Carboloy surfaces are highly resistant to wear—far exceed H.S.S. on tool life. Tools hold accurate diameters, permitting long runs on exceptionally close tolerance work.

These reamers are made both in solid and expansion types. Tools are stocked semi-finished and are ground to size specified with tolerance of .0003" on diameter. A complete range of sizes is available for immediate delivery.

THE STAPLES TOOL COMPANY
CINCINNATI 25, OHIO
Distributors in Major Cities

write for your complete Staples Tool catalog

Staples CARBOLOY CEMENTED CARBIDE TOOLS

A COMPLETE LINE OF SINGLE AND MULTIPLE POINT CUTTING TOOLS
EXPANSION REAMERS • FORM TOOLS • CENTERS • MASONRY DRILLS • SPECIAL TOOLS

QUALITY-BUILT TO DO THE JOB *Right!*

DEFIANCE

for BORING . . . MILLING . . . DRILLING . . . TAPPING

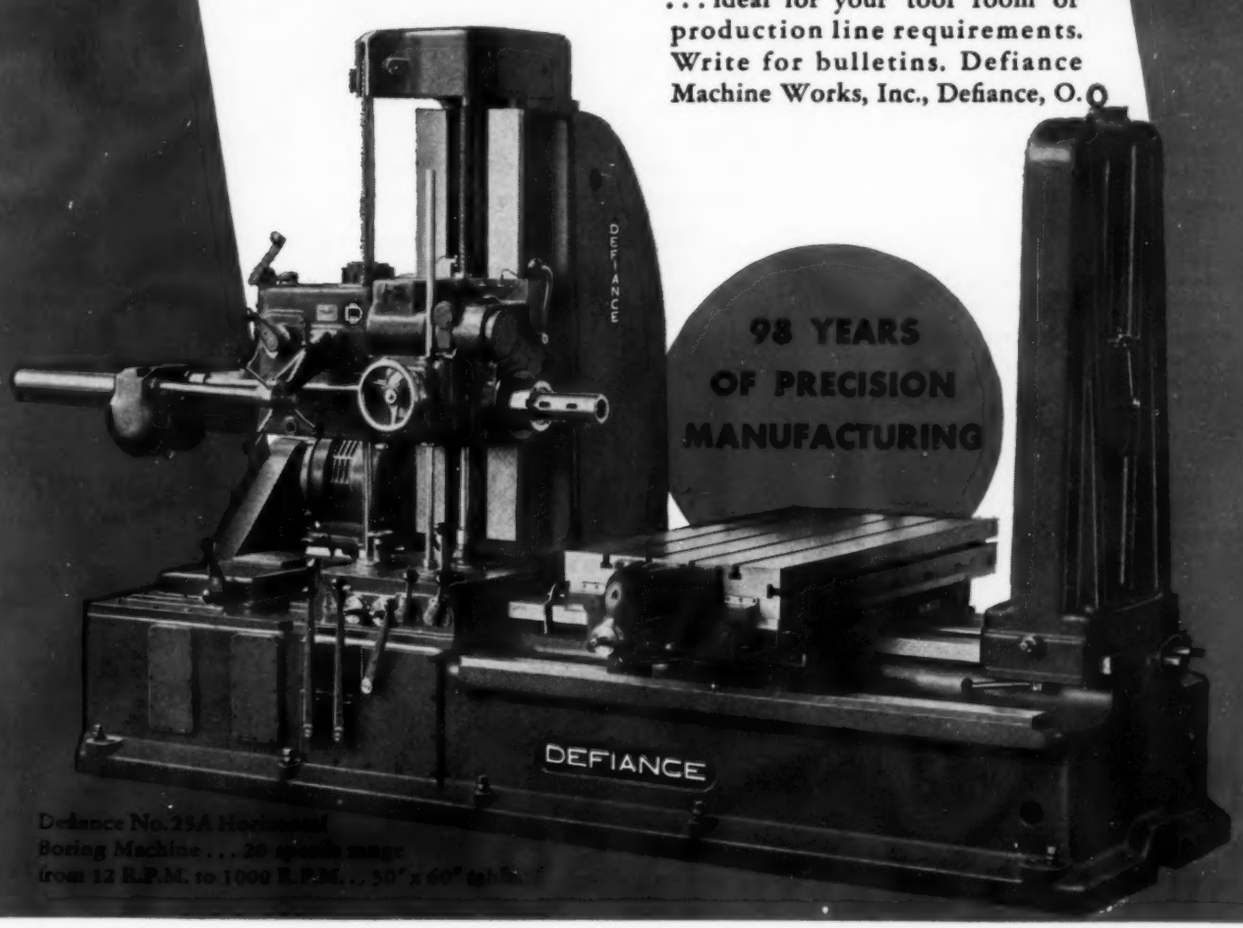
Here's why practical men prefer a Defiance Boring Mill for *top speed* and *accuracy* . . .

EXTRA RIGID! Built oversize with wide outboard supports (48") to handle overhanging work with precision. Bed scientifically ribbed for maximum rigidity . . . extra strength.

WIDE RANGE OF SPEED! Adjustable from 4 R.P.M. to 1000 R.P.M. . . . enables operator to use most efficient tools for each job.

ADAPTABLE TO MANY USES! Special equipment available includes . . . auxiliary tables, hand and power fed; vernier attachments for column and table; dial indicating attachment with end measures for column and table; facing heads and newly announced Universal Milling attachment.

DURABLE! You can't beat Defiance Boring Mills for day-in and day-out dependability. Simple in design . . . trouble-free performance . . . ideal for your tool room or production line requirements. Write for bulletins. Defiance Machine Works, Inc., Defiance, O.



Defiance No. 25A Horizontal Boring Machine . . . 20 spindle range from 12 R.P.M. to 1000 R.P.M. . . . 50" x 60" table

SOUTH BEND 9" PRECISION LATHES

$145.00 AND UP

f. o. b. factory, less electrical equipment and bench.

You can buy a South Bend 9" Lathe on time payments.

9" x 3' South Bend Model A Bench Lathe

FEATURES AND SPECIFICATIONS

SWINGS—9¼" over bed and saddle wings
5½" over saddle cross slide

BED LENGTHS—3, 3½, 4 and 4½ feet

DISTANCE BETWEEN CENTERS—16 to 34 inches

SPINDLE SPEEDS—
depending on type of drive equipment
Six—41 to 658 r. p. m.
Twelve—41 to 1270 r. p. m.
Sixteen—46 to 1176 r. p. m.

POWER LONGITUDINAL FEEDS—
Model A Lathes—48, .0015" to .0853"
Model B Lathes—26, .0021" to .0155"
Model C Lathes—14, .0021" to .0156"

POWER CROSS FEEDS—
Model A Lathes—48, .0004" to .0252"
Model B Lathes—23, .001" to .0046"
Model C Lathes—manual operation

THREAD CUTTING RANGE—
Model A Lathe—48 pitches,
4 to 224 per inch
Models B and C Lathes—45 pitches,
4 to 160 per inch

MAXIMUM COLLET CAPACITY—½ inch

QUICK CHANGE GEAR BOX—Model A Lathes

PLAIN CHANGE GEARS—Models B and C Lathes

The quality that is built into South Bend 9-inch Precision Lathes enables them to produce quality work with efficiency under all conditions. Regardless of the type of machining—between-centers, collet, fixture, or chucking—close tolerances can be maintained and a maximum volume of fine work produced with a minimum of effort. Write for Catalog 9-J which fully describes and illustrates all South Bend 9" Precision Lathes and attachments. Larger sizes with 10" to 16" swings are also shown.

PROMPT DELIVERY—See your South Bend Lathe distributor today—immediate delivery from his stock or early delivery from factory.

PRICES—Starting at $145.00, f. o. b. factory, South Bend Precision Lathes now represent a greater value per dollar of cost than ever before. The average price increase over prewar level is less than 15 per cent.

TIME PAYMENT—South Bend Precision Lathes, tools, and attachments are available on Factory Time Payment terms. 25 per cent down payment, twelve months to pay balance. Moderate finance charges.

SPEED PRODUCTION WITH THESE ATTACHMENTS

COLLET ATTACHMENTS—Handwheel and Handlever types for toolroom and production work. Steel or brass collets—1/16" to 1/2" by 64ths for 9" lathes.

TAPER ATTACHMENT—For turning or boring tapers up to 3-1/2 inches per foot.

MILLING ATTACHMENT—Mounts on compound rest base for milling, boring, and keyway cutting. Cutter arbors available.

ELECTRIC GRINDER—Powerful external grinding attachment for sharpening reamers and cutters, cylindrical grinding, etc.

HANDLEVER BED TURRET—For volume production of small duplicate parts. Turret head holds six tools. Indexes accurately.

DOUBLE TOOL CROSS SLIDE—Handlever or screw feed operated, holds 3 cutter bits.

SQUARE TURRET—Mounts on cross slide. Holds 4 cutting tools for repetitive operations. Indexes accurately—positive lever operated lock. Rocker adjustments for tools.

ALSO—Collet rack, center rest, follower rest, carriage stops, thread cutting stop, face plates, centers, chucks, dogs, tools, etc.

BUILDING BETTER LATHES SINCE 1906

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET
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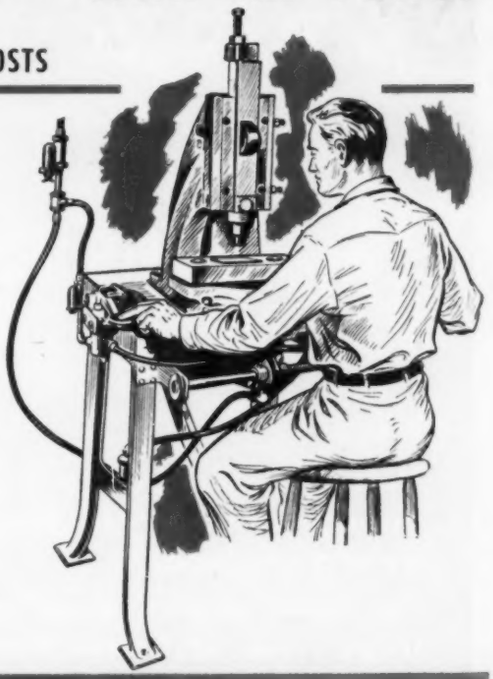
Add Safety to Your Kick Presses — With Air Power

GET: MORE UNIFORM WORK • GREATER PRODUCTION • LOWER COSTS



SCHRADER PNEUMATIC MACHINE CONTROLS CONVERT FOOT (KICK) PRESSES TO AIR-POWER HAND OPERATION

Foot (kick) press operators work faster, with less fatigue, greater safety . . . and turn out more uniform work when foot presses are converted to air-powered hand operation.

It's easy to change any standard kick press to air operation with Schrader Pneumatic Machine Controls. Schrader No. 2148 type Control has a lever type two-hand operating valve assembly with the Schrader Cut-Out Valve safety feature. This prevents operators from tying down either valve for one hand operation. If foot operation is desired, Schrader Foot Pedal No. 9586 can be obtained.

You can eliminate rejects caused by uneven blows, reduce costs and provide safer working conditions for your operators by installing Schrader Kick Press Controls now. Write for complete information today.

FREE! Get your copy of this information-packed 8 Page Booklet describing Schrader Air Control Products

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WRITE FOR COMPLETE INFORMATION TODAY ABOUT THESE AND OTHER SCHRADER AIR CONTROL PRODUCTS

Air-Cylinders—all types
Quick-acting Air Couplers that plug in for air supply
Operating Valves—2, 3, and 4-Way
Blow Guns—Stainless Steel, Drop-forged

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PRODUCTS
CONTROL THE AIR

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Please send me your FREE BULLETIN and more information about the products I have checked in circles below.

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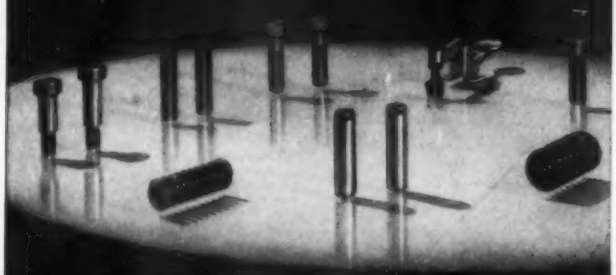
Use "Detroit" Accessories for Dependability



These assembly items are known throughout industry for their quality and precision.

For quick service draw on our large stock of Dowel Pins (163 Standard sizes plus oversizes), Springs, Socket Head Cap Screws, Stripper Bolts, Set Screws and Toggle Clamps.

Standard and Special Die Sets in all sizes.

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2895 W. GRAND BLVD. • DETROIT 2, MICHIGAN

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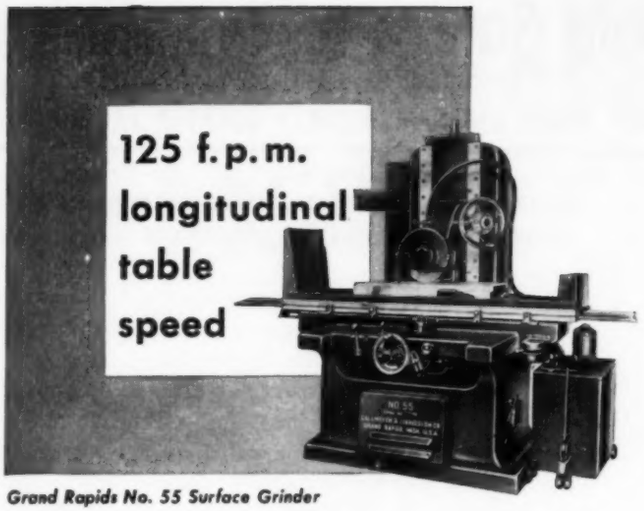

Grand Rapids No. 55 Surface Grinder

Faster precision production is possible with the exceptional table speed of Grand Rapids Hydraulic Feed Surface Grinders. Both longitudinal table travel and cross feed are automatic, hydraulic. Wheel head is powered for rapid vertical travel.

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Manufacturers of Grand Rapids Grinders
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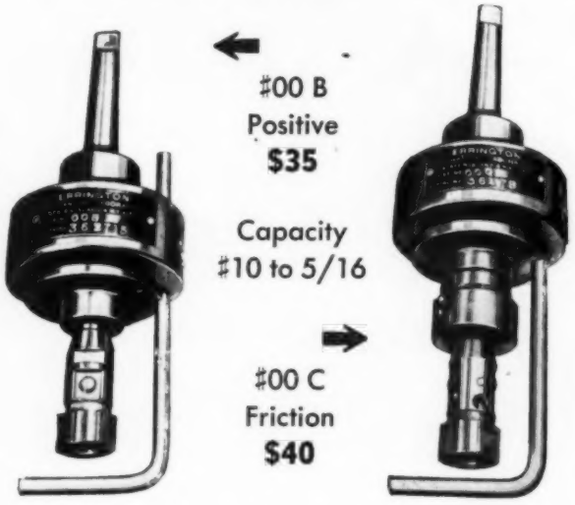
ERRINGTON MECHANICAL LABORATORY, INC.
STAPLETON, STATEN ISLAND 4, N. Y.



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Positive
$35

Capacity
#10 to 5/16

#00 C
Friction
$40

Both equipped with Jacob Rubber Flex Tap Chucks.

Supplied with #1, #2, #3 M.T.
#2 or #33 Jacob Socket Shanks.

Quill Clamps Are $10 to $15.
Other Sizes Up To 2".

These Bolts are too brittle

These Bolts are too soft

These Bolts are just right

Circle Ⓑ Bolts and Nuts . . . both standard and special . . . are carefully inspected for size and strength. Their dependability is a definite asset to products on which they are used.

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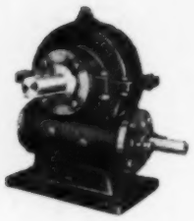
...they are CIRCLE Ⓑ BOLTS

here are "slowdowns" that spell real efficiency



To cut high-speed power sources to fit slower running machines, nothing beats Grant Speed Reducers . . . engineered by gear specialists to fit your requirements . . . made in a wide variety of speeds . . . several combinations of gear styles and shaft arrangements.

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Radial thrust ball bearings
Oil seals
Gears of high test bronze
Worms of chrome vanadium steel
Immediate delivery

There's real long-run economy in getting speed reducers made to give top performance. So specify Grant on your next order.

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ONE good reason why our customers keep coming back to us when they need gears or special machinery is because we give them exactly the kind of work they want.

Our gears are cut precisely to your specifications of any practical material in a variety of sizes ranging from inches up to 30 feet in diameter.

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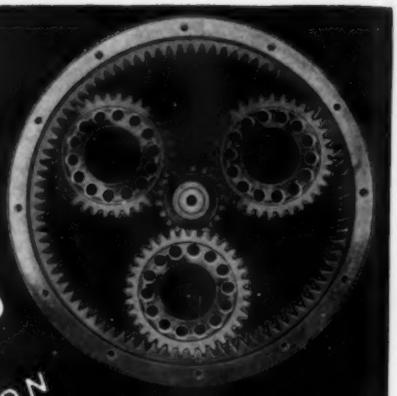
EARLE GEARS

GEARS OF EVERY DESCRIPTION



This planetary gear train is an example of the precision gear work which we handle to our customers' prints and specifications

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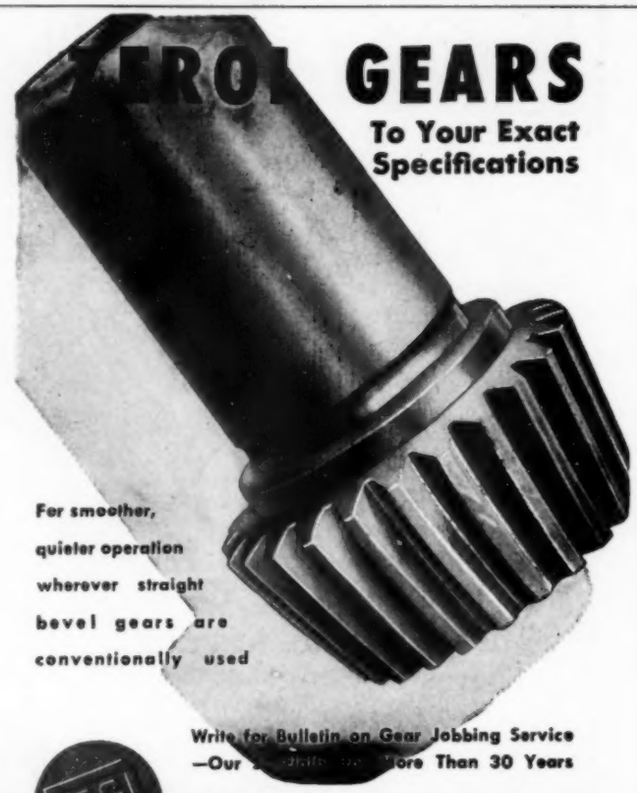
HARTFORD 5, CONN.



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For smoother, quieter operation wherever straight bevel gears are conventionally used

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Better Gear Products

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Geared for Economies

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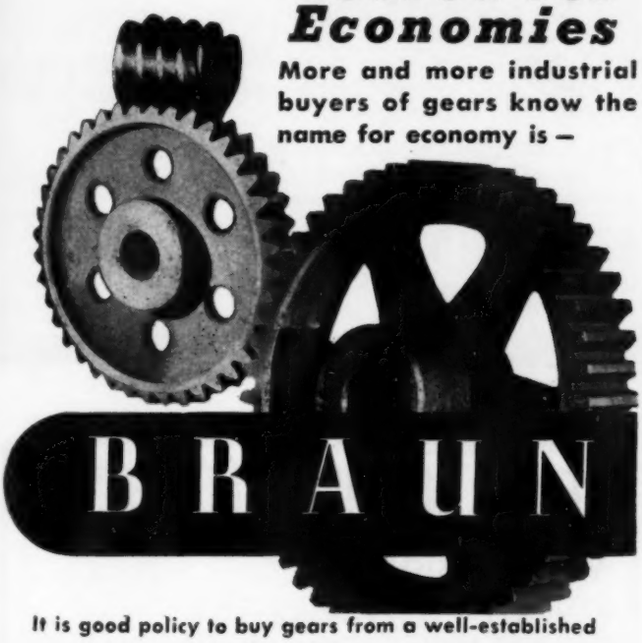

It is good policy to buy gears from a well-established organization with a modern completely equipped factory. Braun has the facilities and experience of 38 years in manufacturing large orders of gears. Send your prints to Braun for estimates without obligation.

BRAUN GEAR COMPANY

Cincinnati ZEROL*..

WIDER OPERATING TOLERANCES
Smoother... Quieter OPERATION
...EASIER ASSEMBLY

Cincinnati ZEROL* bevel gears are recommended to interchange with straight bevel gears in pairs where thrust limitations and other factors do not permit mounting provision for spiral bevels or hypoids.

An outstanding characteristic of Cincinnati ZEROL* bevel gears is the localized tooth contact. This permits a slight tolerance in positioning gears when assembling. For smoother . . . quieter operation with faster assemblies we suggest Cincinnati ZEROL*.

*Registered in the U. S. Patent Office.

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"Gears . . . Good Gears Only"
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Spiral and helical gears; special couplings, bushings and collars; pins, pulleys and rollers. Made to your specifications—*promptly.*

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Up to 60" dia.

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"MO-CUT" . Braeburn Alloy Steel Corp.
"STAR MAX" . . . . Carpenter Steel Co.
"MOLITE M-1" . Columbia Tool Steel Co.
"REX T-MO" . Crucible Steel Co. of America
"DI-MOL" . . . Henry Disston & Sons, Inc.
"HI-MO" . . . . Firth-Sterling Steel Co.
"REX T-MO" . . . . . Halcomb Steel Co.
"MOGUL" . . . . . Jessop Steel Co.
"TATMO" . . . Latrobe Electric Steel Co.
"MIDMAX" . . . . . The Midvale Co.
"S. T. M." . . . Simonds Saw & Steel Co.
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1 MO-MAX was the first of the modern molybdenum high speed steels. Since 1933 it has been widely used in all types of cutting tools.

2 MO-MAX has superior cutting qualities.

3 The machinability of MO-MAX is unexcelled.

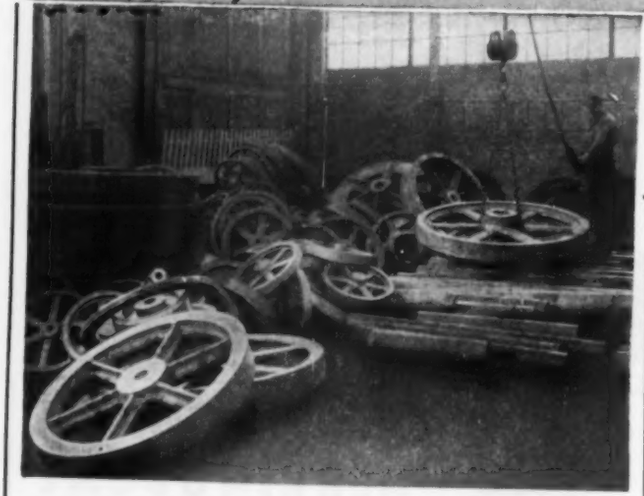
4 MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.

5 MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.

LEARN ALL THE FACTS! *Send for your copy of the MO-MAX Handbook, seventh edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.*

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street • Cleveland 14, Ohio

Waiting.. but not for long!



These big gear blanks, waiting to be sent to the machines for cutting illustrate the capacity of the Stahl plant. They're waiting, but they won't wait long, because Stahl equipment and Stahl skill in handling this type of work will speed them through the shop and out to you—big gears . . . well cut!

We are Big Gear Specialists, equipped to handle spurs up to 6' in diameter, and other sizes in proportion. For any type of gear—any size, any quantity—get a Stahl estimate first!

STAHL GEAR & MACHINE CO.
3901 Hamilton Avenue Cleveland 14, Ohio

GEAR CUTTING MACHINES

Well Designed
Good Features
Create Production Advantages

43 Years' Experience

NEWARK GEAR CUTTING MACHINE CO.
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FRANK E. EBERHARDT, *President*

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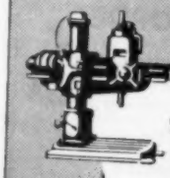
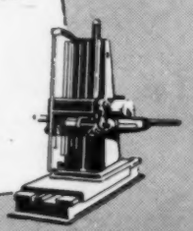


PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



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There's a good reason why PITTSBURGH Spur Gears give longer, trouble-free service. Engineering and production "know-how" plus scientific heat treatment are the answer. Furnished from 24 to 1¼ DP, with diameters from 1½" to 75"; face widths to 20". Inquiries invited.

Specify PITTSBURGH
HELICALS • INTERNALS
BEVELS
SPURS • WORMS
SPECIALS

PITTSBURGH GEAR COMPANY
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PITTSBURGH 22, PA.

PIONEER PRODUCER OF QUALITY GEARS

GEARS SPURS, SPROCKETS SPIRALS, BEVELS

Short or production runs
guaranteed workmanship
reasonable prices

THE PRECISION GEAR CO.
743 Main Street, Walpole, Massachusetts

ATLANTIC FOR GEARS
Our service on small gears, due to new equipment recently installed, will interest you.
Send samples or blueprints for quotation

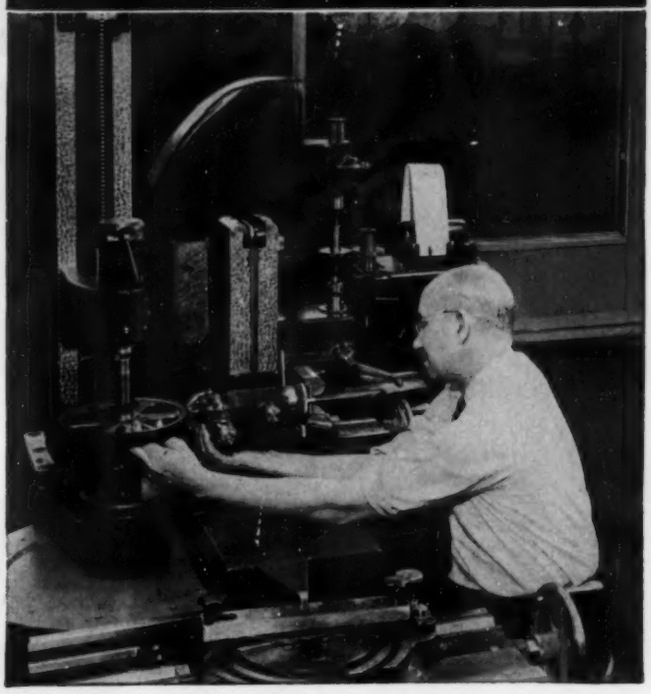
ATLANTIC GEAR WORKS, INC.
200-D Lafayette St., New York 12, N. Y. Phone CAnal 6-1441

MP QUALITY GEARS CUT TO ORDER MP

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston Mass.

We're always looking FOR TROUBLE!



SIER-BATH *for precision-built gears*

TO accomplish near-perfection in gear making, Sier-Bath begins with the cutters which are mechanically checked at each sharpening. Gears are checked for accuracy of tooth form, spacing, concentricity and helix angle by mechanical checkers in the Sier-Bath air-conditioned checking room. Finishing is done on such precise machines as the Red Ring Shaver, J.&L. Thread Grinder, and others. Send your gear specs to Sier-Bath for quotation.

GEAR RANGE:

• Spur, helical and worm gears to 48" Dia. 3 D.P. and finer; straight tooth bevel gears 32 pitch to 3 pitch, up to 23" P.D. depending on ratio. Gears shaved from 1" to 24". Continuous Tooth Herringbone Gears generated by Sykes Method up to 37" O.D. Worms and threads precision ground on J.&L. Thread Grinder to extremely close tolerances. Spur gear grinding up to 16" diameter. Helical gear grinding up to 10" diameter. Involute and straight side splines up to 42" between centers.

ALSO MAKERS OF SIER-BATH SCREW AND GEAREX ROTARY PUMPS

FOUNDED 1905 MEMBER A.G.M.A.

Sier-Bath GEAR and PUMP CO., Inc.

9246 HUDSON BOULEVARD NORTH BERGEN, NEW JERSEY

Here's the press to take with you on that desert isle

● Ferracute
Inclinable Utility Press
5 to 150 tons

If you had to pick just one, this is it! Busiest press in hundreds of plants today. Versatile! Profitable! "When no other press can do it at a profit, put it on a Ferracute." Engineered from Ferracute's 84 years' experience for efficient low-cost CUTTING .... PUNCHING .... STAMPING .... SHALLOW DRAWING .... FORMING. Built to Ferracute's well-known standards of *extra* strength, *extra* capacity, *extra* safety factor. Inclinable models from 5 to 150 tons. *Immediate shipment on several popular sizes.* Very prompt delivery on all. Write for full specifications and information.

FERRACUTE

MACHINE COMPANY

Bridgeton, New Jersey, U.S.A.

A DOUBLE SAVING with SCULLY-JONES Style A TAP CHUCKS

① Reduce tap breakage and time lost for changing.

② Speed up production by quick insertion and ejection.

See pages 25, 26, 27, Scully-Jones Catalog No. 500

*In a standard spindle with a Morse Taper Hole

*In Scully-Jones Floating Holder

*In Floating Tension Type Tap Driver for Magic Chuck

*In a Magic Quick Change Chuck

*In a Spring Compression Tap Driver

Universally used for individual or modern mass production, the Scully-Jones Style "A" tap chuck is a one-piece tool designed for driving taps in any type of machine having a spindle, holder or attachment with a Morse taper hole.

True-running, definite stop, positive drive, smaller in diameter than spindle, quick insertion and easy ejection, are advantages that reduce tap breakage and speed up production.

Write for our complete listing of sizes.

5 Big FEATURES

STYLE "A" TAP CHUCKS

1. Drives By Square—a positive drive
2. Centers By Shank—for correct alignment
3. Collet Action—locks tap in chuck
4. Taper Shank—fits any M.T. hole
5. Four Point Bearing—gives collet action

Scully-Jones AND COMPANY

1900 SOUTH ROCKWELL STREET • CHICAGO 8, U.S.A.

★
SAVES TIME
MAKES MONEY
★
CUTS ANY SHAPE
CUTS ANY SIZE
★
CAPACITY UP TO
1/4" STOCK

MARSHALLTOWN
THROATLESS SHEARS

Here's the shear that offers best performance features. Cutting speed 6' per minute. High grade tool steel cutters. Write today for details. Prompt shipment.

MARSHALLTOWN MANUFACTURING COMPANY
910 Nevada Street Marshalltown, Iowa

VALVAIR Solenoid Valves

Diagram shows double-acting air cylinder operated by Valvair 4-way solenoid valve, spring return.

DEPENDABILITY — That's outstanding in Valvair performance. Solenoids are Stellite-welded to resist wear; do not mushroom. Standard Valvairs have operated over 2,000,000 times at 100 lbs. with never a leak. *Exclusive features.* Patented basic design eliminates metal seats; non-corrosive (cast bronze body, stainless steel parts); full pipe area used with minimum drop. 2-way, 3-way, 4-way types. Get full details and prices.

Ask for Bulletin AA

VALVAIR CORPORATION • 454 Morgan Avenue, Akron 11, Ohio

Valvair

"BRALE"
DIAMOND
PENETRATOR
made only by WILSON

WE CAN'T TAKE CHANCES ON A 0.00008" TOLERANCE

• The "BRALE" Diamond Penetrator was designed by Wilson for use on the "ROCKWELL" Hardness Tester to test hardened steel—some hard alloys. Every one must be as nearly perfect as we can make it. Here's why:

A deviation in the indentation of 0.00008" (or 0.00004" in the "ROCKWELL" Superficial Tester) would cause an error of one point in the hardness reading. The reputation and universal acceptance of "ROCKWELL" Hardness Testers are based on dependable accuracy. We cannot risk the reputation and acceptance of "ROCKWELL" Hardness Testers by permitting any chance of error.

Every "BRALE" Penetrator is ground to shape under enormous magnification—tested on many test blocks in our Standardizing Laboratory.

WILSON

MECHANICAL INSTRUMENT CO., INC.
AN ASSOCIATE COMPANY OF AMERICAN CHAIN & CABLE COMPANY, INC.

230-B PARK AVENUE, NEW YORK 17, N. Y.

ACCO TRADE MARK

ATTAINS 1650° F. QUICKLY
Atmospheric Pot Hardening Furnace

"BUZZER" HIGH SPEED *Gas* FURNACES

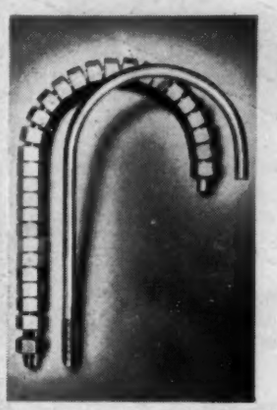
. . . are the efficient, economical answer to today's Heat Treating Problems. NO BLOWER or OTHER AUXILIARY POWER are needed . . . just connect to your gas supply.

• The Full Muffle Furnace attains a temperature of 2400° F., and The Pot Hardening Furnace, tangentially fired, assures quick even heat up 1650° F. Many other models available.

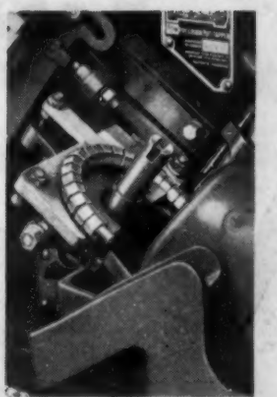
• Send for the "BUZZER" Catalog showing full line of Industrial Gas Furnaces, Burners and other equipment.

CHARLES A. HONES, INC.
121 So. Grand Ave. Baldwin, L. I., N. Y.

ATTAINS 2400° F. QUICKLY
Full Muffle Furnace



NATIONAL PATENTED 180° BENT SHANK TAP is so supported that tapping torque cannot force it from its true axis. Hence it cuts precision threads rapidly and economically.



Holder removed showing tap in position on machine. Precision built, "freely" mounted and bathed in fan-cooled cutting compound, tap life is greatly increased.

FASTER – MORE ACCURATE

● **Here is a new High Speed Precision Nut Tapper which taps nuts 50% faster than any other equipment, and holds to Class III or IV fits.**

This non-reversing machine uses the National patented 180° "hook" tap. This unique design results in the tapping strains being parallel with the shank, thus reducing deflection to the vanishing point. Greater accuracy and longer tap life are the result.

Furthermore, an automatic sorter presents the nuts "bottom face" against pusher, consequently they are tapped square with the bearing face.

These exclusive features, plus full electrical control; automatic shut-off; high efficiency cutting compound cooling system, and automatic machine lubrication make the National High Speed Precision Tapper the most highly developed machine of its type on the market.

Why not investigate its possibilities?

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF
MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET AND WIRE NAIL MACHINERY

New York Detroit Chicago

Talide
(TUNGSTEN CARBIDE)
Drawing Dies
20 to 100 Times the Life of Steel Dies
DRAWING DIES
(For Wire, Tubing and Bar Stock)
SPINNING AND CURLING ROLLERS
PIERCING AND LAMINATION DIES
UP TO 24" I.D.
SWAGING DIES
(For Forming Solid and Tubular Shapes)
POWDER METALLURGY DIES (For Compacting Powdered Metals and Materials)
BLANKING AND FORMING DIES
(For Stamping Lamination Discs, Metals, Plastics, Paper)
Talide
(TUNGSTEN CARBIDE)
Performance!
TUBE MANDRELS
HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Collapsible Tubes)

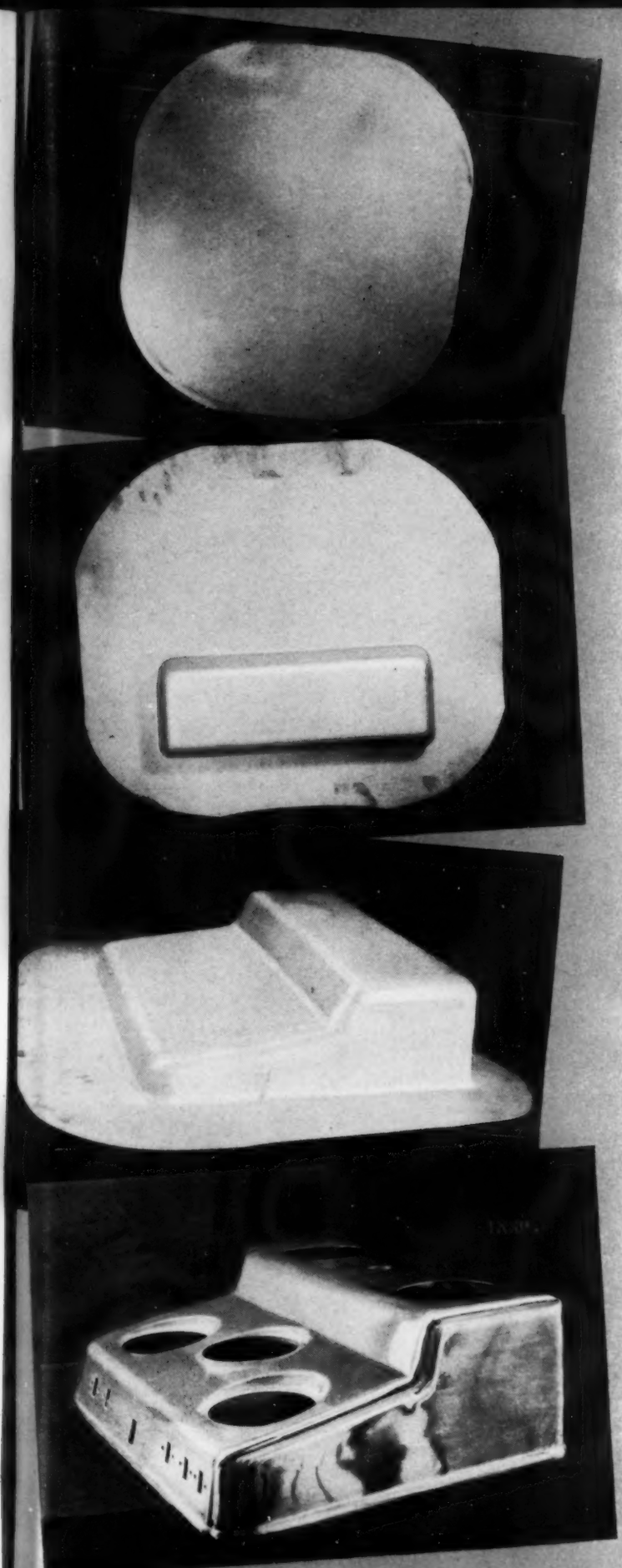
Isn't low unit cost your ultimate objective? You get more speed and output on long production runs and at lower maintenance cost with the superior quality of Talide Dies. Talide Dies out-perform and out-wear steel dies 20 to 100 times. Talide (the hardest metal made) saves up to 50 hours polishing and redressing time on a single die. And, since Talide Metal takes and imparts the smoothest finish possible, surface defects are practically eliminated. Purchase Talide (tungsten carbide) Dies in any practical shape and of inside diameter up to 24".

Write for Die and Wear Part Catalog 46-WP.

TALIDE METAL MEETS EVERY REQUIREMENT

SINTERED CARBIDES
MC
TALIDE
PRESSED CARBIDES

METAL CARBIDES CORPORATION
YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*
CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS



Solved!

...This Tough Draw on Stainless Steel

THE JOB

Drawing fountain body bases for automatic coffee makers from No. 304 stainless steel—thickness .050—9-inch draw. There are 13 steps in the operation as carried out at the Solar Aircraft Company, Des Moines, Iowa. Four major drawing steps are illustrated.

THE PROBLEM

The job was difficult because of the depth of draw and the complex structure—it was square with a step and taper on one side. The metal had to be held at certain points to prevent wrinkling, and at the same time it had to flow freely to prevent breaking and to obtain the required 35% metal in the corners.

THE SOLUTION

Solar Aircraft engineers, Standard Oil Technical Service Representatives and the Standard Oil Research Laboratory collaborated on the development of a new stamping compound and method of application.

THE RESULT

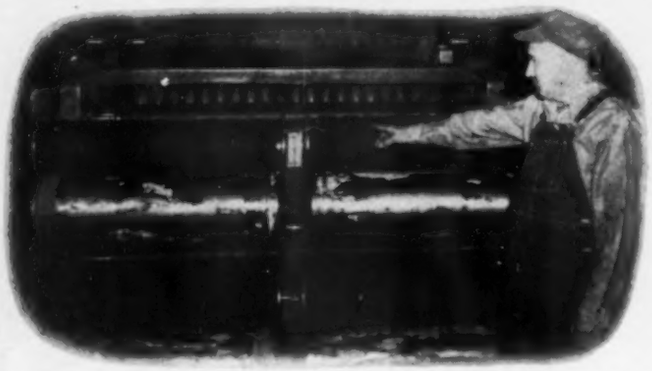
The finished part is free from structural weakness due to metal fatigue. Rejections have been reduced to a minimum. Die life has been excellent, and high production schedules have been obtained. The product possesses a highly satisfactory finish and appearance.

The Lubrication Engineering and Laboratory services of Standard Oil are available to any manufacturer in the Middle West who has a problem of metal drawing or machining operations. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, for the Lubrication Engineer nearest you.

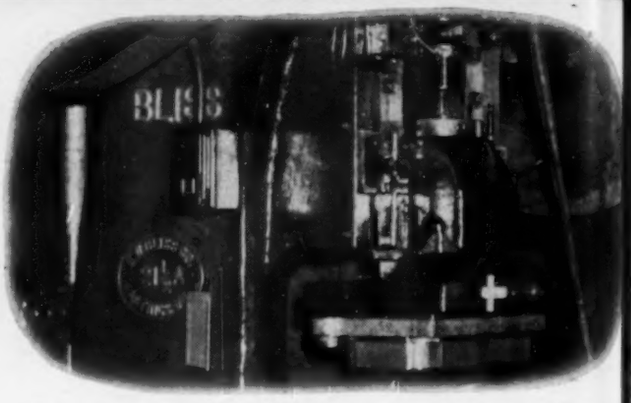
STANDARD OIL COMPANY (INDIANA)

STANDARD

Stanodrip ...Stays on those hard-to-lubricate spots



Stops oil leakage. Cleanliness counted in a midwest woolen mill. Oil drip from carding machine bearings was staining finished wool products. Stanodrip lubricated these bearings without leaking. Oil consumption went down 50%.



Cuts oil consumption. Lubricant run-off from the bearings on stamping and drawing presses caused excessive oil consumption, made floors dangerously slippery, and made bearing lubrication uncertain. Stanodrip provided safe, positive lubrication for the bearings, lowered oil consumption 80%.

Prevents bearing wear. Six breakdowns due to burned-out bearings occurred on this fast-turning planer in the year before Stanodrip was installed. Stanodrip's adhesive and lubricating properties stopped the trouble. Bearings were thoroughly covered and lubricated despite the planer's high speeds. Oil consumption dropped 50%.

Resists run-off. Conventional oils ran off the slide bearings of this high-speed wood veneer slicer. To prevent bearing wear, and to thus avoid inaccurate work, three oilings were needed each eight-hour shift. When Stanodrip was given the job, it stayed on the slides, gave adequate protection. Oilings per shift were reduced to one.

You can count on Stanodrip to solve oil leakage, drippage, or throw-off problems in your plant. Because of its unusual stringiness and driplessness, this unique oil adheres to hard-to-lubricate surfaces. It protects these surfaces against wear by its excellent lubricating ability and high resistance to oxidation or gumming.

To help you gain the economical advantages of Stanodrip in your plant, a Standard Oil Lubrication Engineer is at your service anywhere in the Midwest. Write Standard Oil Co. (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

STANDARD OIL COMPANY (INDIANA) STANDARD

ACME-MORRISON STITCHER FOR PRODUCTION ASSEMBLY

Stitches Metal like Paper

Acme Steel Company is now manufacturing and servicing the remarkable Acme-Morrison Metal Stitchers, formerly known as Morrison Steel and Aircraft Stitchers.

The Acme-Morrison Metal Stitcher fastens metal to metal, or nonmetallic materials to metal.

Just like the stitch of your office stapler, in a single operation this machine forms its own stitch (or staple), drives and clinches it. *No prepunching is required.*

The Acme-Morrison Metal Stitcher comes in several models and can be used advantageously in a variety of industries. It will stitch aluminum, steel, copper, brass, bronze, certain grades of stainless steel, cork, asbestos, rubber, wood, canvas, and other such materials.

For further details about what these money-saving Metal Stitchers can do for you, mail the coupon today.

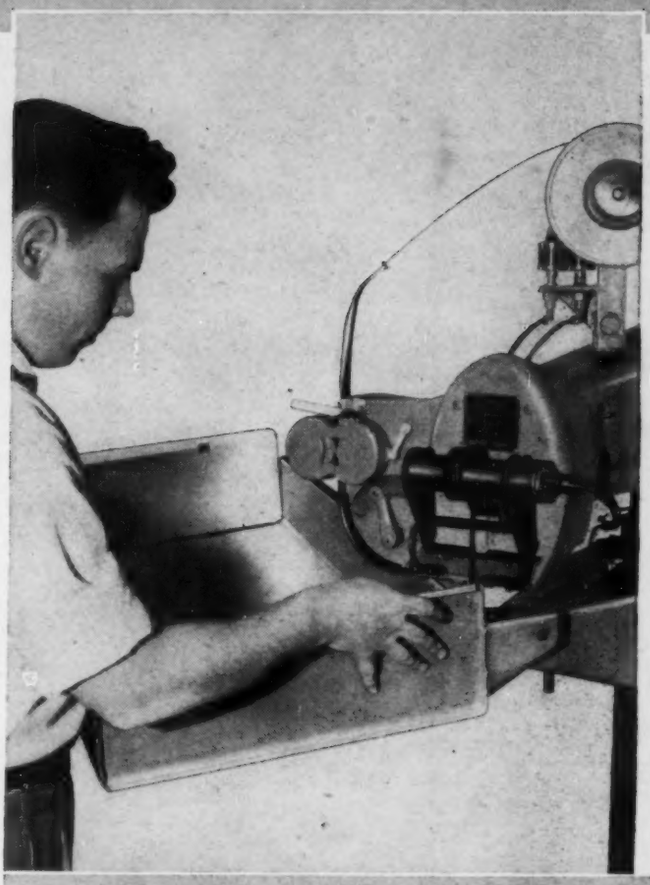
STITCHING WIRE DIVISION

ACME STEEL COMPANY

NEW YORK 17 ATLANTA CHICAGO 8 LOS ANGELES 11

Fasten Metal to Nonmetallic Materials

Aluminum stitched to steel
Textile stitched to aluminum
Aluminum, leather and copper stitched together
Aluminum, plywood and brass stitched together



NO PREPUNCHING

Replaces RIVETS – SCREWS – NAILS – BOLTS – SPOT-WELDING

Acme Steel Company, Dept. AM-28
2840 Archer Avenue
Chicago 8, Illinois

Gentlemen:

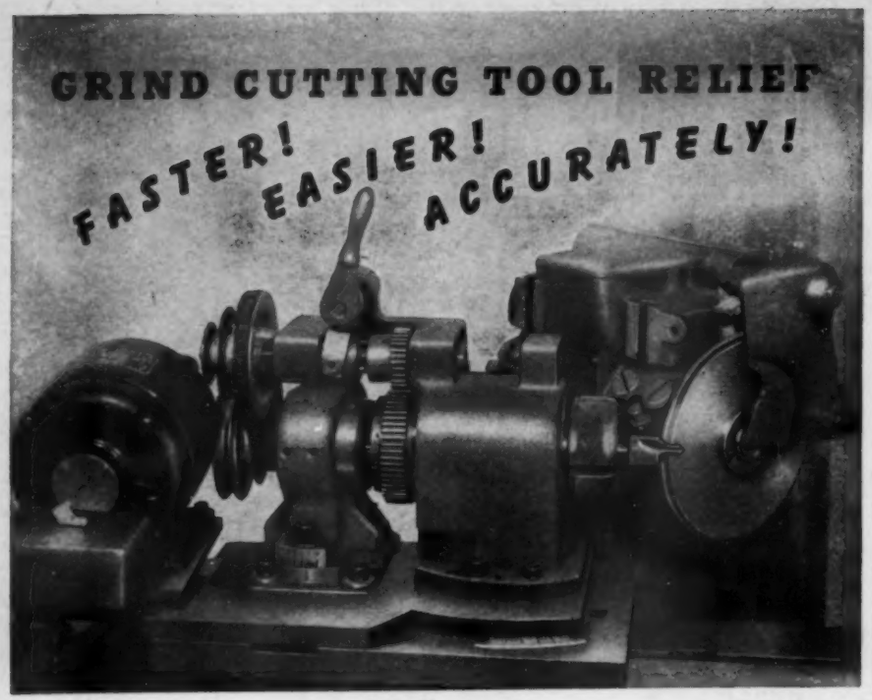
Please send me further details about the Metal Stitcher.

Name_____

Company_____

Address_____

City_____ State_____



WITH THE

CIRCULARITY-GRINDING ATTACHMENT

for

- ★ Form Relief — Radial Relief — Form and Radial together — Straight and Tapered Cylindrical Grinding
- ★ Easily mounted on all Universal and Cutter Grinders
- ★ Work held between dead centers or in collet
- ★ No special cams or fixtures needed for any set-up

DEVELOPED by the Detroit Reamer & Tool Company, the Circularity-Grinding Attachment has been used successfully for several years in the manufacture and reworking of cutting tools. Form relief, radial relief, form and radial relief together, straight and tapered cylindrical work all may be accurately ground with this attachment . . . thus in many cases it replaces a motor-driven headstock.

The work may be held in a collet (0" to 1¼") or between dead centers. In either case the work always revolves on its own axial center. Set-ups are simple and the Circularity-Grinding Attachment provides identical relief on every tool ground from the same set-up.

Send for our new illustrated bulletin which gives complete explanation of set-up and operation of the Attachment. Write today.

SEE IT at Booth 608 A.S.T.E. Show

D R & T COMPANY

DETROIT REAMER & TOOL CO.

Mfrs. of Special High Speed Cutting Tools

2830 East 7 Mile Rd. Detroit 12, Michigan

SCHERR *aids to precision – production*

THE COMPARITOL

Where inspection accuracy to "Tenths" and better is absolutely essential in such parts as gages, threads, fine wires, cylindrical ground work, etc., the Scherr Comparitol will give indisputable results. It can be used by anyone with a few minutes' instruction, can be placed near machines for constant spot inspection, as well as used for final inspection. Long-lived patented knife-edge mechanism needs no oiling, has no gears, racks, multiple levers, pivots or bearings, no electrical connections, bulbs or transformers. Thousands in profitable use everywhere. Price—complete with serrated table 6", $165.00—8", $185.00.

SCHERR DIAL INDICATORS

Last longer and cost less. Have an exclusive mechanism of extra sturdiness, with only three moving parts. No quick spinning wheels nor unhardened racks. Furnished with standard back or with ball-joint back for setting at any angle. Contact points for all needs. With clamp holder, extension bar, tool-post holder, in compact metal case. Price —indicator only, $10.00—complete set with universal attachments, $19.75.

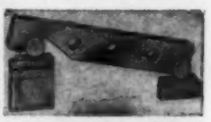
ULTRA-CHEX GAGE BLOCKS

The last word in modern basic accuracy brought within the grasp of all shops large and small. Sets in size for all budgets. All blocks accurate to 5 millionths. Illustrated is the 34-block set, giving 80,000 combinations in steps of 1/10,000", with optical flat for checking wear. Low prices allow for constant practical shop use in setting tools, checking gages, locating holes in jigs, and fixtures, etc. Many shops use a number of sets, with one master set for reference. Price—9 block set for Toolmakers and micrometer checking, $27.50. 34 block set, $125.00

OPTICAL FLATS

Essential for checking wear and flatness of lapped surfaces. Reveal deviation in millionths from absolute flatness or parallelism of micrometer anvil, gage blocks, refrigerator, airplane parts, etc. Sizes up to 4" or over in optical glass or quartz. Price—1¼", $10.00.

SINE BAR



Thoroughly normalized for undeviating accuracy. Two sizes — 1"x⅜"x5", Price —$19.00 ground—$26.00 lapped, and 1"x1¼"x5", Price — $26.50 ground — $36.50 lapped. Type G has ground edges. Type L lapped edges. Extremely low price makes this valuable tool available for the individual owner as well as in quantity for the toolroom.

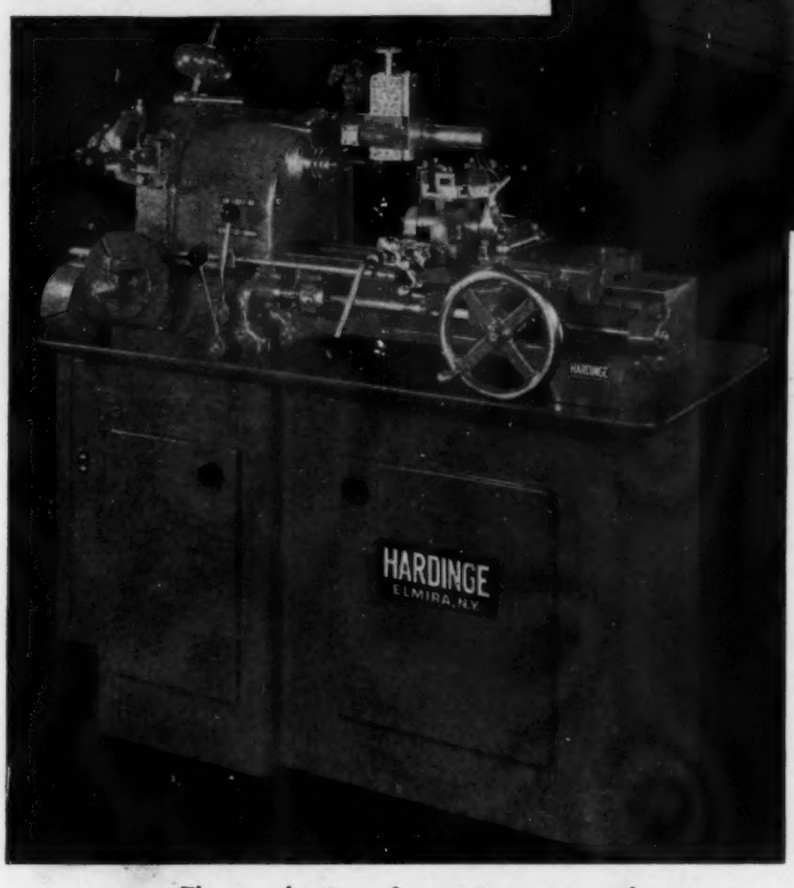
Write for full details on these tools, and for the Scherr Small Tool Catalog.

GEO. SCHERR CO., Inc.

200-D Lafayette St. New York 12, N. Y.

HARDINGE
ELMIRA, N.Y.

HIGH SPEED
PRECISION PRODUCTION MACHINES



SECOND OPERATION MACHINE: 1" collet, 6" step chuck, 5" jaw chuck capacity; eight spindle speeds to 4000 r.p.m.; preloaded ball bearing construction for spindle and turret; hardened and precision ground steel ways; turret and cross slide operating levers are adjustable to suit the operator.

Write for descriptive bulletin DSM59.

MULTI-OPERATION CHUCKING MACHINE: This machine has the same capacity as the Second Operation Machine. In addition, it has an eight-position turret, production threading head and power feed for the carriage.

Write today for bulletin HP which shows how this machine can handle various jobs, using standard tool bits only . . . for low-cost tooling.

The production of precision parts today requires tool room accuracy with high speed operation to reduce and then maintain lower costs. The above machines are both designed to increase the output of parts to extremely close tolerance and finish specifications. The precision qualities of these machines, combined with the simplicity of operation, assure lower costs.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. EXPORT OFFICE, 269 LAFAYETTE ST., NEW YORK 12, N. Y.

CENTRAL INDUSTRIES LTD.

30 Church St. New York 7, N. Y.

—HAS—

for Immediate Delivery

at reasonable prices

RAMIT

UNIVERSAL GRINDERS

UNIVERSAL PLATE CUTTERS

PLATE BENDERS

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THESE are reliable machines made by a leading Swedish firm and exclusively distributed by Central Industries Ltd.* in U.S.A. and Canada. Immediate shipments are made from New York

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WRITE for Bulletins and quotations.

** Responsible dealers invited.*

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Machinery Division

CENTRAL INDUSTRIES LTD.

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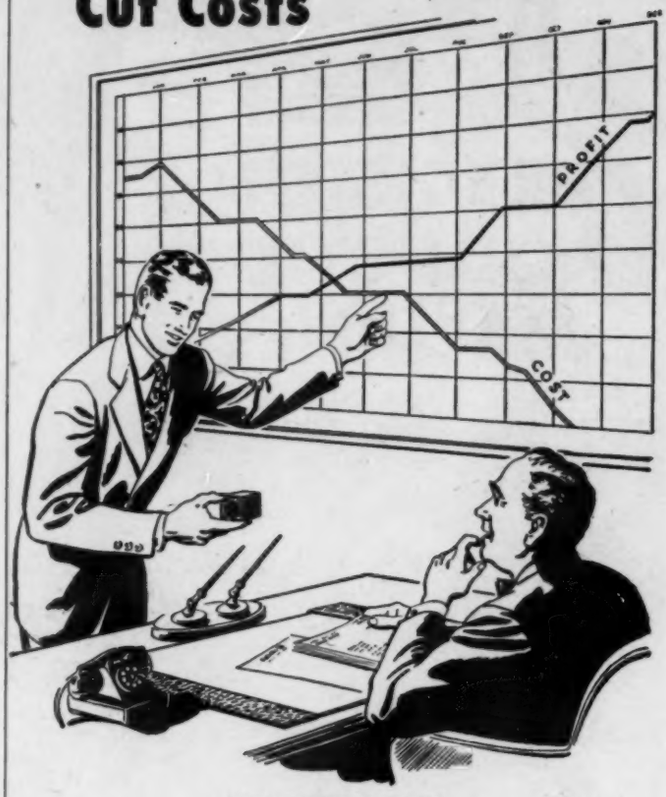
How to Increase Profits Cut Costs

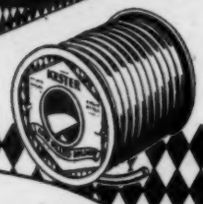


USE KESTER SOLDER

Today, high labor costs are a major problem. Increase the efficiency of your production and maintenance work by using Kester Cored solders. Their pureness, dependability, and uniformity will speed up any soldering operation.

Use Kester Acid-Core solder for general work; Kester Rosin-Core solder for all electrical work.

Be Sure With Kester



KESTER SOLDER

KESTER SOLDER COMPANY

4223 Wrightwood Avenue, Chicago 39, Illinois

EASTERN PLANT: NEWARK, NEW JERSEY • CANADIAN PLANT: BRANTFORD, CANADA

For Positive Protection on Many Eye-Hazardous Jobs

AO ACETATE SAFETY GOGGLES

Introduced in the past year, this goggle of non-flammable cellulose acetate butyrate combines *assured protection* with unusual comfort — and is already a leader in the AO line of safety equipment. Hinges and temples are out of line of sight, and with lenses that conform to and cover eye orbit, unusual working vision results.

Other appealing features are the exceptionally light bridge and nosepads which balance goggle weight evenly. Available with ventilated side shields which protect eyes from "sideswiping" and lenses from fogging. Also available with 6 Curve Super Armorplate clear or Calobar lenses. Recommended for a wide variety of operations such as chemical and physical lab work, chipping, grinding, riveting, machine and hand tool work, spot welding, bottling . . . and with Calobar lenses when protection from glare, heat, ultra-violet or infrared radiations is required. Your AO Safety Representative can supply you.

Safety Division of American Optical COMPANY

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

INCREASE YOUR CUTTING BETTER THAN 30%

with **MILFORD WAVY SET BAND SAW BLADES**

YOUR OWN MACHINES ARE YOUR BEST PROVING GROUND

TEST A MILFORD WAVY SET BLADE against the field!

Yes . . . it's true . . . enthusiastic users tell us that 30% increased production on horizontal and vertical cut-off band saw machines *is conservative.*

These blades of unique design eliminate ripping of teeth . . . and cut with greater precision and closer tolerance. One pitch, 10-tooth blades can be used for cutting bar stock, angles and pipe.

Available in the ¾" 10 and 12-tooth sizes for immediate shipment.

Now individually packed in cartons for ease in handling

Your Industrial Supply Distributors are always ready to serve your needs for all factory and mill supplies as well as MILFORD WAVY-SET and other blades. Order through them.

MILFORD PROFILE AND BAND SAW BLADES RESISTOR AND DUPLEX HACK SAW BLADES

THE HENRY G. THOMPSON & SON CO.

Saw Specialists Exclusively for Over 70 Years

NEW HAVEN 5, CONNECTICUT, U. S. A.

SPEED UP SMALL JOBS with "YANKEE" VISES

"Yankee" 1993 Vise, removed from swivel base and held by "Yankee" Vise Clamp for drilling and tapping.

Bench-mounted on quick-release swivel base.

Machine-mounted with "Yankee" Clamp.

Sides, bottom and front end accurately machined.

Vise lifts on and off swivel base.

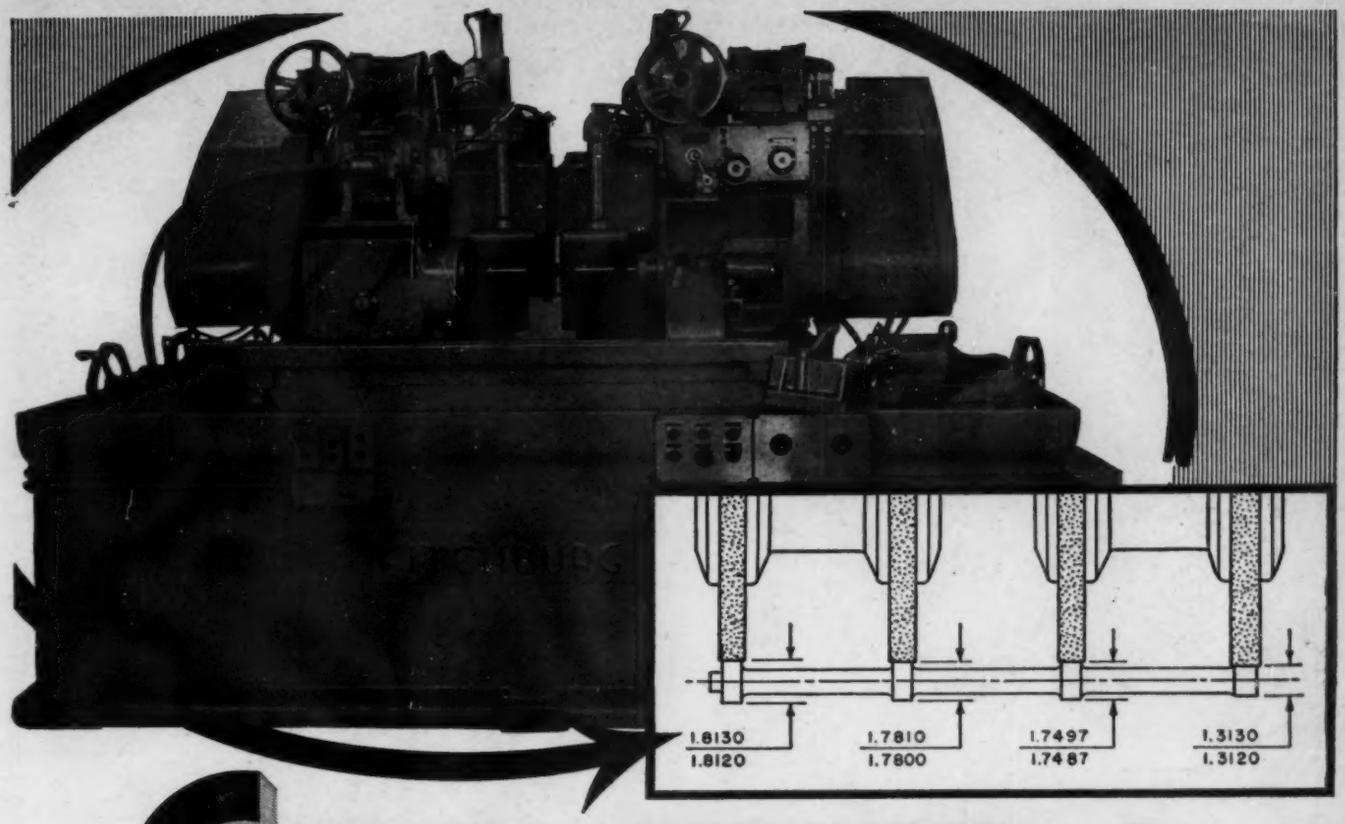
Line up small work just once in a "Yankee" Vise for a whole series of hand and machine operations. Four sizes . . . 1½", 2", 2¾" and 4" jaw widths . . . with and without swivel base. Hardened steel "V" block for round stock. Your industrial distributor has a full stock.

Write for The "YANKEE" Tool Book

"Yankee" Tools now part of STANLEY

THE TOOL BOX OF THE WORLD

NORTH BROS. MFG. CO.
Philadelphia 33, Pa.



FITCHBURG

IS AUTOMATICALLY BETTER GRINDING CAMSHAFT BEARINGS

It's not difficult for Fitchburg to design and build surprisingly inexpensive, special purpose, automatic cylindrical grinding machines. We simply take one or more Fitchburg Bowgage Wheelheads—the most efficient, completely automatic cycle wheelheads made—and place them on a suitable base.

The result is an automatic mass-production grinding machine that is *easy* on its operator—*easy* on your tool budget—and enables you to produce at an amazingly low cost-per-piece.

An example is the illustrated Two-Head Fitchburg Grinder used for grinding the four bearings on a camshaft. Each of the two Standard Bowgage Wheelheads (one right-hand and the other left-hand) carries two spaced wheels on a wheel center.

All four camshaft bearings are ground at the same time—in one operation—*at one push of a button.* All movements, and correct sizing, are completely automatic. The work stops rotating automatically, practically instantly, when the wheels withdraw. About the only attention necessary is loading and unloading the work-pieces.

Let us study *your* cylindrical grinding problems for the attainment of maximum profitable production. There is no obligation for this service.

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders

Like external form tools

BOKUM BORING TOOLS

—maintain their original form throughout the entire life—which assures uniformity of resulting product

—provide constant clearance—thereby making for uniform tool performance

—require resharpening only on top surface—thus reducing maintenance cost

—have a longer life than any other type of boring tool

AVAILABLE IN 3 STYLES

STYLE A — *for general boring*

STYLE B — *for facing and bottoming*

STYLE C — *for internal threading*

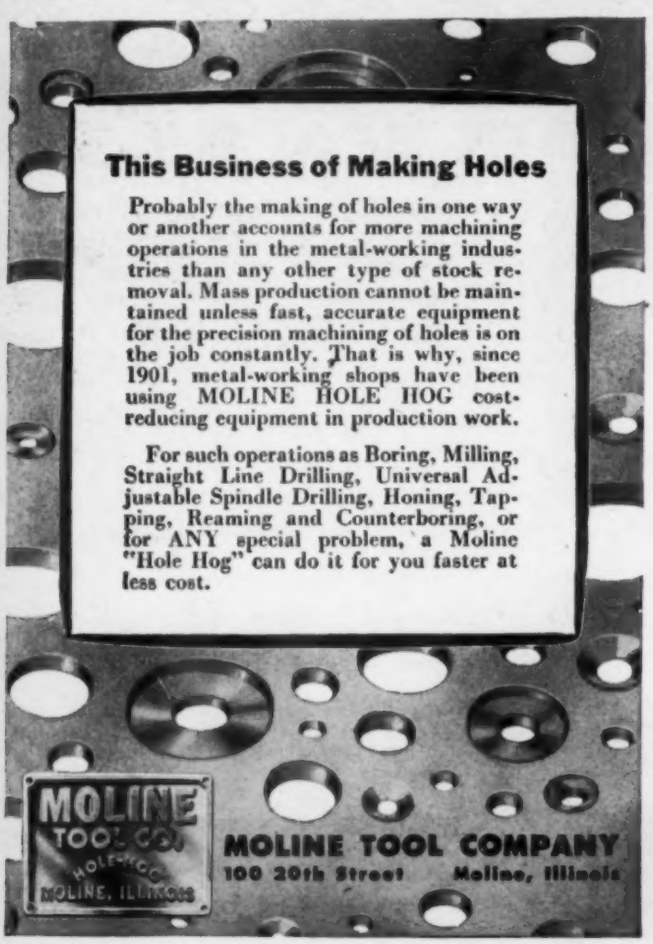
Ask for catalog K1139 for super high speed tools and for K398 for carbide-tipped.

TRADE MARK REG. U. S. PAT. OFF.

BOKUM TOOL CO.

14775 WILDEMERE AVE.
DETROIT 21, MICH.

SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS



This Business of Making Holes

Probably the making of holes in one way or another accounts for more machining operations in the metal-working industries than any other type of stock removal. Mass production cannot be maintained unless fast, accurate equipment for the precision machining of holes is on the job constantly. That is why, since 1901, metal-working shops have been using MOLINE HOLE HOG cost-reducing equipment in production work.

For such operations as Boring, Milling, Straight Line Drilling, Universal Adjustable Spindle Drilling, Honing, Tapping, Reaming and Counterboring, or for ANY special problem, a Moline "Hole Hog" can do it for you faster at less cost.

MOLINE TOOL CO. HOLE HOG MOLINE, ILLINOIS

MOLINE TOOL COMPANY
100 20th Street Moline, Illinois

"The Outstanding Basic Improvement in FLEXIBLE SHAFT Machinery in 25 Years"

The NEW Strand Rotoflex 4-speed gear drive Flexible Shaft Machine (shown upper right) is another step forward in Strand quality precision tools for faster, easier, more economical production work. The Rotoflex 4-speed gear drive employs a patented, new type of quick change gear drive utilizing 4 positive speeds by a unique and easy method of instantly changing from one speed to another. Rotoflex machines are powered with totally enclosed ball-bearing motors having speeds from 850 to 9000 R.P.M., depending on motor.

Standard type Strand machines, (lower right) give portable rotary power at constant speeds with dependable results in all grinding, buffing, drilling, wire brushing and rotary filing operations. Hundreds of types and models from ⅛ to 3 H.P. available with suitable attachments for your specific requirements.

Distributors in all principal cities
Ask for Bulletin No. 43 and Catalog No. 30

Strand FLEXIBLE SHAFTS

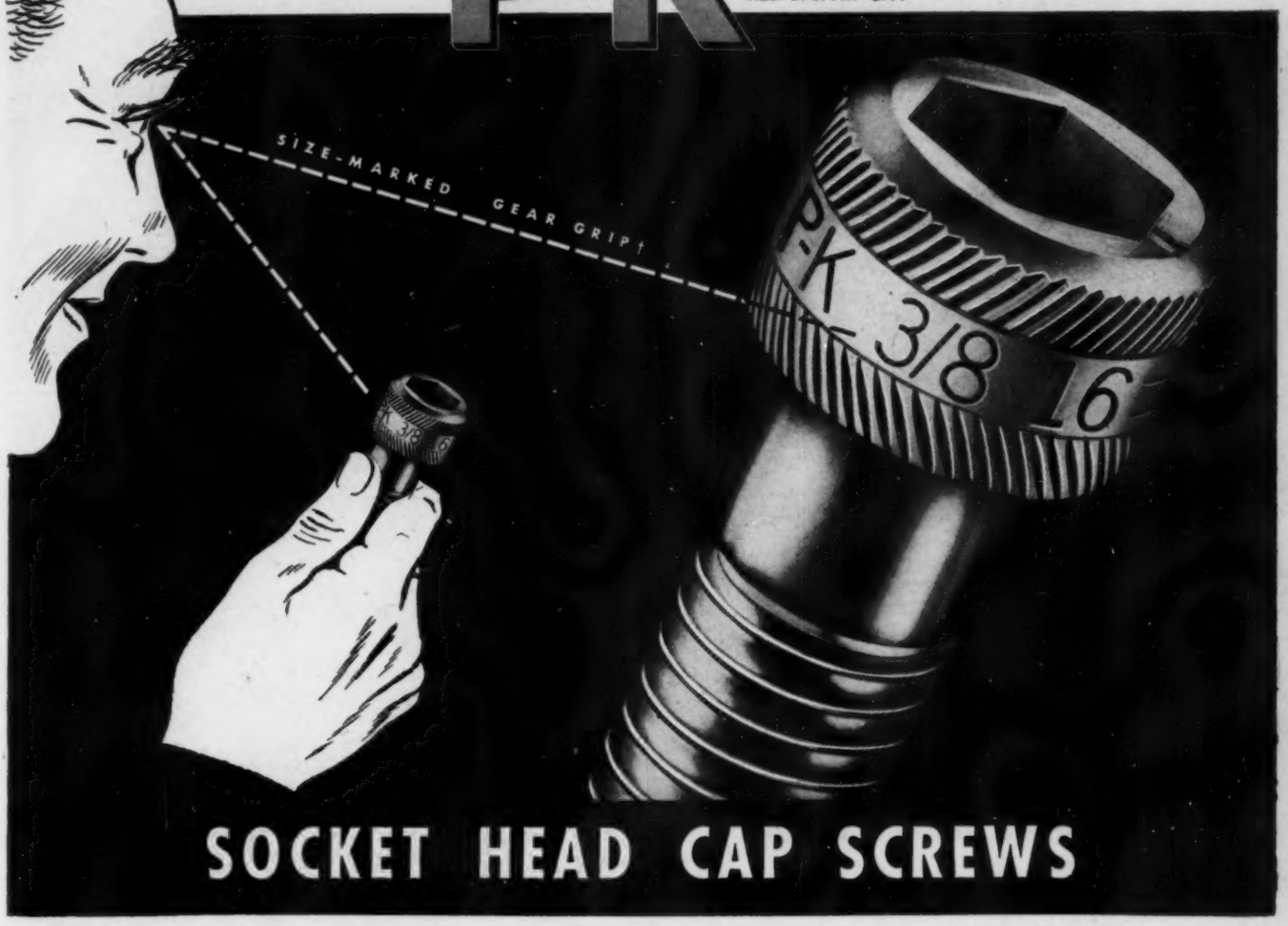
N. A. STRAND & CO.
5009 NO. WOLCOTT AVE.
CHICAGO 40, ILL.

Why take a chance..

You can tell at a glance ...

with P-K* SIZE-MARK

*REG. U. S. PAT OFF.



SOCKET HEAD CAP SCREWS

†U. S. PAT. No. 126,409

ONE QUICK GLANCE tells you the size of a P-K Size-Marked Gear Grip Socket Head Cap Screw. No need to "mike" or gauge it . . . no chance for error! New workers learn faster — can work faster. Servicing and repair work on your product is made simpler and easier.

EVEN EXPERIENCED MEN need the Size-Mark, because tests show that many guess wrong on size and thread pitch. That means time out to find out.

GEAR GRIP prevents slipping and fumbling, speeds assembly, especially when busy hands are oily.

LET THIS DOUBLE FEATURE — the Size-Mark and Gear Grip — save you time and trouble. Only P-K offers both in Socket Head Cap Screws. Ask for samples. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

AVAILABLE FOR PROMPT DELIVERY

PARKER-KALON COLD-FORGED SOCKET SCREWS

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS

OTHER PARKER-KALON PRODUCTS SELF-TAPPING SCREWS · HARDENED SCREWNAILS AND MASONRY NAILS · SHUR-GRIP · FILE AND SOLDER IRON HANDLES · METAL PUNCHES · DAMPER REGULATORS AND ACCESSORIES

OUT OUR WAY
WELL, WE'RE DOWN TO OUR LAST TWENTY BAGS OF SOL-SPEEDI-DRI, AND I DIDN'T WANT TO BE CAUGHT---
WELL, ORDER SOME MORE! ORDER A DOZEN CARLOADS! TWENTY, IF YOU NEED 'EM!
BEIN' A BIG EXECUTIVE DON'T LOOK SO HARD-- JUST HOLLER, "GIT IT! GIT WHUT YOU NEED!"
THAT'S TH' KETCH--IF YOU NEED 'EM! BUT, BOY, HE DON'T HAFTA WORRY! WE KIN ALLUS USE SOL-SPEEDI-DRI AROUND TH' SHOP!
J.R.WILLIAMS
AUTHORITY
COPR. 1948 BY NEA SERVICE, INC. T. M. REG. U. S. PAT. OFF.

YOU CAN COUNT ON SOL-SPEEDI-DRI

American industry has learned that it can depend on the uniformly high quality of SOL-SPEEDI-DRI—the field's original and foremost absorbent for all liquids. This quality is guarded carefully from mine to user by the most modern methods and equipment. The raw material for SOL-SPEEDI-DRI is obtained by *selective* mining, and is transformed, under constant laboratory control, into the finished product. There's no waste in SOL-SPEEDI-DRI. Packed in special moisture-proof bags, every grain of SOL-SPEEDI-DRI comes to you at the peak of efficiency to give you the most for your money.

SOL-SPEEDI-DRI has been tested and proved by American industry. The result? More SOL-SPEEDI-DRI is used by the nation's shops and plants than any other material of similar nature! That's ample proof of SOL-SPEEDI-DRI'S out-in-front performance. Remember, if SOL-SPEEDI-DRI is *on* the bag, quality is *in* the bag!

WHEN YOU BUY, BE *SURE* IT'S SOL-SPEEDI-DRI!

Safety and Maintenance Co., Inc., No. 1 Wall St., New York 5, N. Y.

Warehouse Stocks Maintained in Principal Cities of the United States and Canada

The Lyon

INTERNAL GROOVING TOOL

Its versatility saves costly preparation time — provides precision grooving of single or multiple grooves at a production rate—plus economy of set-up time — and low initial cost.

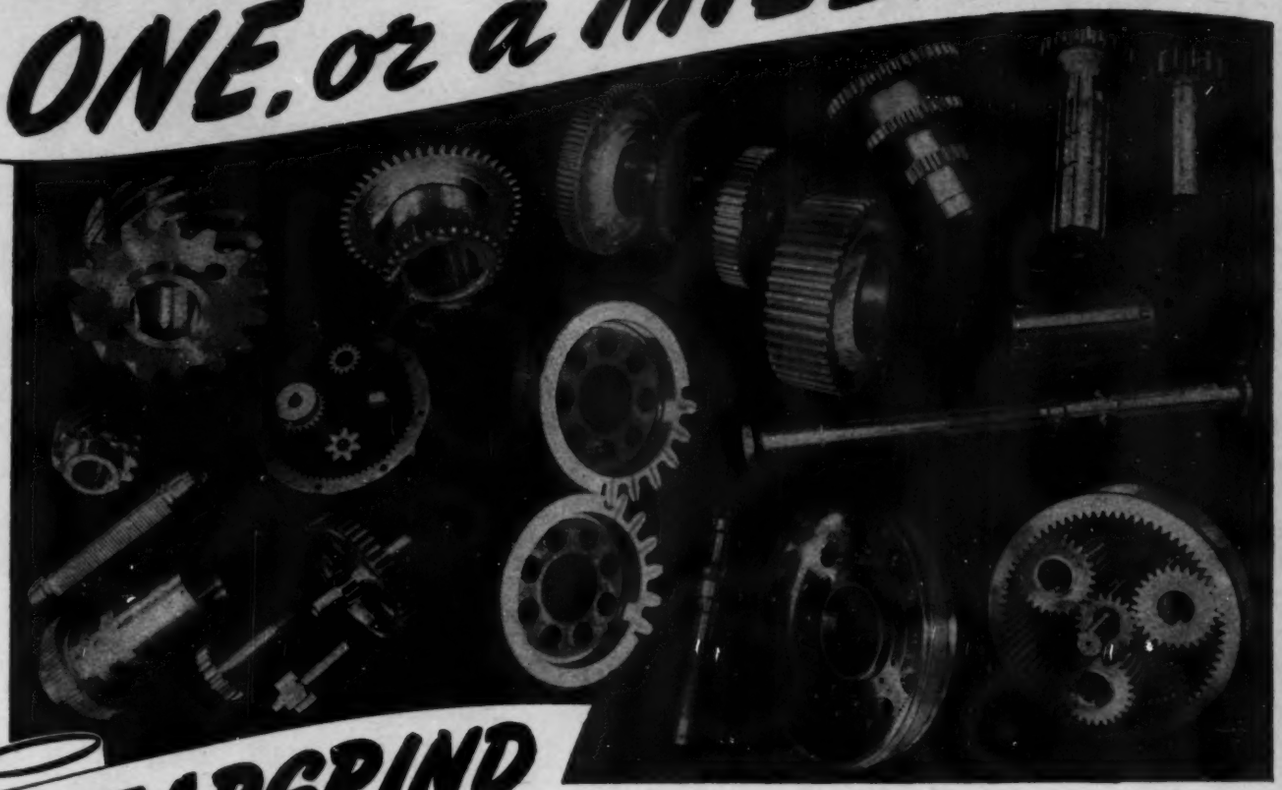
The LYON has been designed for making internal grooves to tolerances of .001" using any drill press, turret lathe, radial drill or automatic equipment.

By changing only bushings and cutters within the tool model range, you have at your command a wide variety of bore sizes and shapes. A simple adjustment regulates location and depth of groove. Work cannot be scratched or marred because the head of the tool does not turn when the cutter operates.

Our Engineering Department will welcome the opportunity of discussing any grooving problem without obligation.

LYON MACHINE CO., WORCESTER 3, MASS.

ONE, or a MILLION!



GEARGRIND
CONTRACT GRINDING SERVICE

Don't Scrap Those Gears Or Splines!

Before scrapping any gears or splines because of distortion in heat treat or errors in machining, ask us about SALVAGE GRINDING. We have saved our customers thousands of dollars by putting our superb grinding facilities and years of experience into salvaging operations.

You can save time and expense by using the Geargrind Contract Grinding Service.

What you believe to be a complex problem may be a simple grinding operation to us, as the work is done on machines manufactured by us, giving us full advantage of their versatility and speed.

Write for Full Information

For a single piece or production runs, GEARGRIND has the plant facilities, equipment and know-how to meet your requirements on all types of Formed Wheel Grinding. Your work will be accurate, finely finished, and delivered on time. This service is available for:

External Spur Gears

From ½" to 33" O.D. 1¼ to 64 pitch. Pinion gears up to 60" between centers. Any desired pressure angle.

Internal Involute Spur Gears and Splines

From 2½" to 17" P.D. 4 to 64 pitch. Maximum face width 5". Any desired pressure angle. Number of teeth up to 200. Maximum O.D. 26". V shaped Splines of any included angle.

External Helical Gears

From 1" to 13⅜" O.D. 4 to 28 pitch. Face width up to 2¾". Left or right hand helix. Minimum lead 8¼". Any desired pressure angle.

Splines and Serrations

Up to 16" diameter, 60" between centers, parallel sides or V shaped of any included angle.

Internal Helical Gears

We have limited facilities for grinding this type gear.

We have ground experimental gears with 160 teeth, 10 diametral pitch. 22°-30' pressure angle. 26° helix angle. 17¾" O.D. We invite inquiries for this type of work.

Straight or Oblique Racks

Lengths up to 26". Width of work up to 4". From 3 to 32 pitch. Any desired pressure angle.

We also produce master gears, spline gauges, spline work arbors, plug gauges, cluster gears and gears of cramped design, punches, dies, sprockets, and master index plates. Salvage grinding of gears, which due to distortion in heat treat or errors in machining would otherwise be considered scrap.

Write, wire or phone for full information.

The GEAR GRINDING MACHINE COMPANY
DETROIT 11, MICH. U.S.A.

When you're faced with shortages, need equipment parts, or must ship finished products to meet contract dates—use the speed and handiness of Air Express and your worries are over. Air Express is the fastest possible way to ship or receive; cuts days off shipping time.

Air Express goes on all flights of the Scheduled Airlines—with air speeds up to 5 miles a minute. Special door-to-door service (no extra cost!) speeds up your shipments still more. Use the speed of Air Express regularly. You'll find rates are surprisingly low.

Specify Air Express-World's Fastest Shipping Service

- Low rates—special pick-up and delivery in principal U.S. towns and cities at no extra cost.
- Moves on all flights of all Scheduled Airlines.
- Air-rail between 22,000 off-airline offices.
- Direct air service to and from scores of foreign countries.

True case history: Machine parts made in Camden were needed in Chicago. 32-lb package picked up 11 A.M. the 28th, delivered 5 P.M. same day. 669 miles, Air Express charge only $6.88. Gave days more time to complete the job. Other weights, any distance, similarly inexpensive and *fast*. Just phone your local Air Express Division, Railway Express Agency, for fast shipping action.

AIR EXPRESS
GETS THERE FIRST

Rates include pick-up and delivery door to door in all principal towns and cities

AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE

SCHEDULED AIRLINES OF THE U.S.

A COMPACT PUMP *For Your High Pressure Needs . . .*

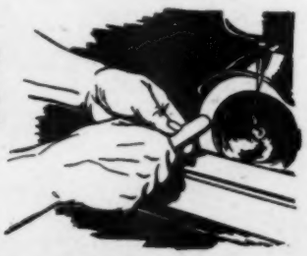
by TUTHILL

To save space, material and money in high pressure service for hydraulic mechanisms and other industrial machinery, specify Tuthill Model CK internal-gear rotary pumps. These compact, dependable pumps are furnished in capacities up to 50 g.p.m. and pressures up to 400 p.s.i. Direct motor drive, V-belt units and integral drives.

Write for Model CK bulletin

TUTHILL PUMP COMPANY
939 East 95th Street • Chicago 19, Illinois

Stop Loading and Glazing with Oakite Coolants



IF you are having difficulty keeping wheels clean and free-cutting in wet grinding operations, switch to Oakite Soluble Oil.

Widely-used Oakite Soluble Oil not only minimizes loading and glazing, but provides maximum cooling . . . gives precise lubrication. When you make up your grinding coolants with Oaklite Soluble Oil you get uniform stable emulsions that make wheel-dressing less frequent . . . assure precision finishes.

In-plant tests with Oakite Soluble Oil for both machining and wet grinding operations—yours for the asking. Drop a note to Oakite Products, Inc., 24 Thames St., New York 6, N. Y. for further details.

OAKITE
REG. U. S. PAT. OFF.
SPECIALIZED CLEANING MATERIALS • METHODS • SERVICE
Technical Service Representatives in Principal Cities of U. S. & Canada

A SAFER, BETTER

non-repeat clutch

NOW AVAILABLE ON

FEDERAL PRESSES

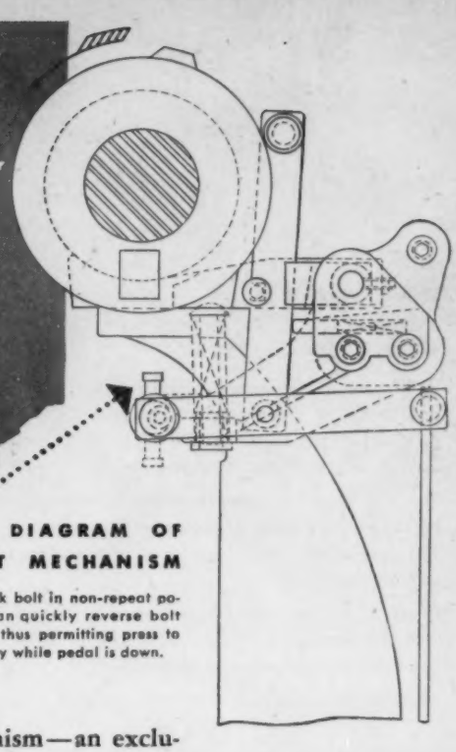
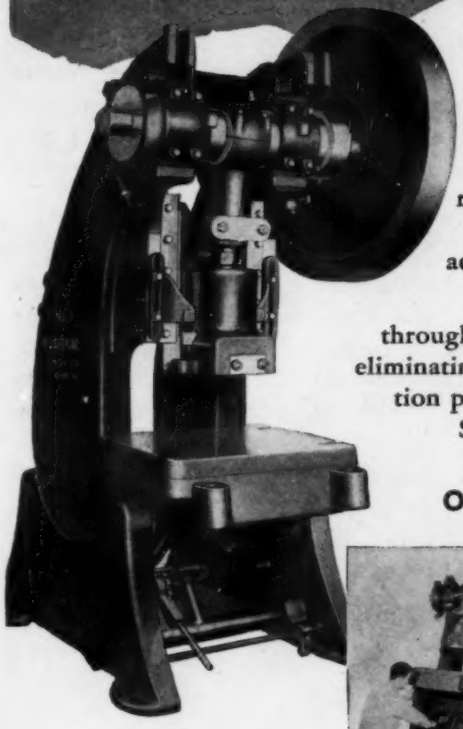


DIAGRAM OF NON-REPEAT MECHANISM

Arrow points to lock bolt in non-repeat position. Operator can quickly reverse bolt 180° (dotted line), thus permitting press to operate continuously while pedal is down.



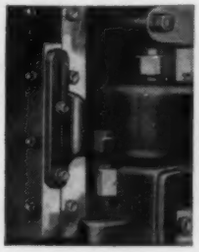
Available in 8 sizes—Capacity 6 to 80 tons.

The Non-Repeat Clutch mechanism—an exclusive Federal feature—is now standard on all Federal Presses. It is simple in construction, yet positive in action. Regardless of how slowly or quickly the clutch is depressed, the press will not repeat accidentally. To engage or disengage the mechanism, the operator need not move from his working position or use any tools. His only action is a mere flick of the finger.

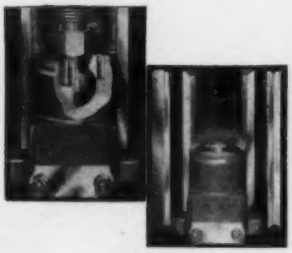
This and other features have earned for Federals an enviable reputation throughout the metal-working industry—a reputation of increasing production, eliminating accidents, cutting costs. Federal Presses may help to solve your production problem. Write today for new catalog. The Federal Press Co., 148 Division Street, Elkhart, Indiana. Telephone 2831.

OTHER FEDERAL COST-CUTTING FEATURES

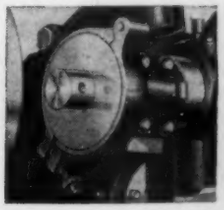
All Federal Presses may be reclined from the front—adjustment made quickly and easily by one man. Lock bolts hold press in desired position.



Knockout bracket is anchored to frame. Results: no danger of misalignment due to knockout bar impact. This reduces time out for adjustment, cuts costs.



The ram on Federal Presses is symmetrical, giving equal distribution of weight and balance; it is bored in exact alignment with "V" ways. Such careful construction adds to accuracy, speed and efficiency of press.



Shock from thrust and return strokes is transmitted to frame—no strain on bearings and caps. Brakes (spring tension) are quickly, easily adjusted.

FEDERAL *Open back Inclinable* PRESSES

AUTOMATIC

Custom Made
METAL STAMPED
NAMEPLATES

FM *Quality*

★ The most economical and satisfactory way to obtain metal stamped nameplates in practically any size or shape is through Dayton Rogers Metal Stamping Service.

Our die stamping process means economy, uniformity, quality, and outstanding appearance. Quantities as low as 50 or 100 nameplates can be produced at much lower cost than by any other method.

Many of the big names in industry use Dayton Rogers service. Any arrangement of letters and type of letter, such as solid, outlined or script can be obtained.

WE PRODUCE nameplates from sheet steel, aluminum, stainless steel, brass, and chromium plated steels.

Send
YOUR LAYOUT FOR QUOTATION
•
ASK FOR A Free Sample

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Manufacturing Company
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The
KALAMAZOO
***Metal Cutting* BAND SAW**

FAST
VERSATILE
ACCURATE
SAFE

Cut costs by speeding production—saving labor and reducing investment. A low-cost machine adaptable to 95 per cent of all cut-off work.

Continuous cutting action—cuts to close limits—and handles solids, tubes or odd shapes.

Production model illustrated, suitable for continuous production. Plain model without coolant for intermittent cutting.

Built-In off-the-floor COOLANT

A Product of
MACHINE TOOL DIVISION
Kalamazoo Tank & Silo Company
KALAMAZOO 16, MICHIGAN

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"MILLING CUTTERS and HOW TO USE THEM"

An authoritative presentation on a subject of vital interest to every machine shop supervisor.

This handy booklet, originally a series of 12 illustrated articles which appeared in *American Machinist*, is available again. Original demand for this practical, helpful working guide to the use of milling cutters was so heavy that we have reprinted the series and bound them in a convenient 36-page booklet for your use.

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Please send me.....copies of "Milling Cutters and How to Use Them" at 50c each. I enclose $..... (Check, money order, stamps.)

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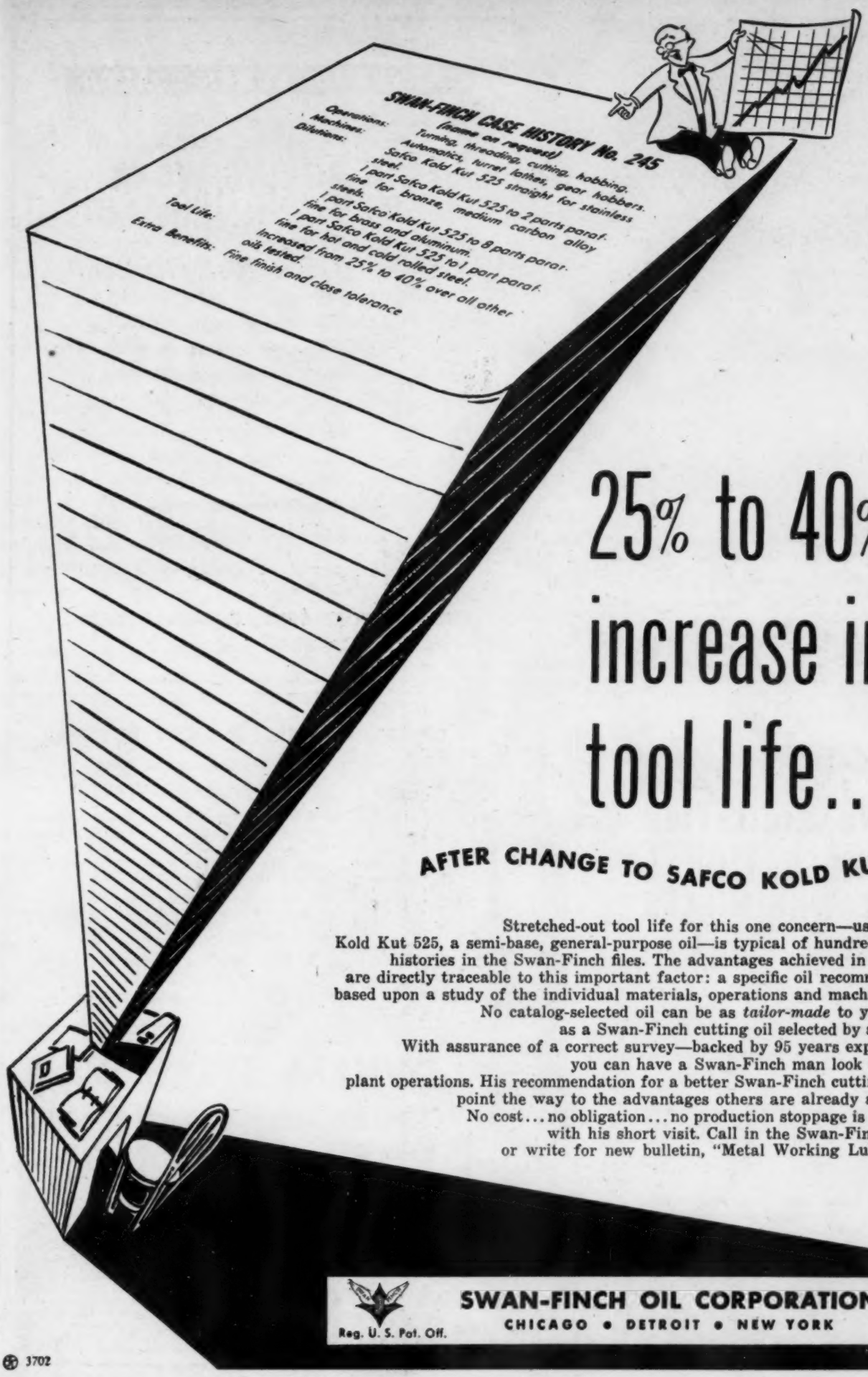
SWAN-FINCH CASE HISTORY No. 245
(Issued on request)
Operations: Turning, threading, cutting, hobbing.
Machines: Automatics, turret lathes, gear hobbers.
Dilutions: Safco Kold Kut 525 straight for stainless steel.
1 part Safco Kold Kut 525 to 2 parts parat-fine for bronze, medium carbon alloy steels.
1 part Safco Kold Kut 525 to 8 parts parat-fine for brass and aluminum.
1 part Safco Kold Kut 525 to 1 part parat-fine for hot and cold rolled steel.
Tool Life: Increased from 25% to 40% over all other oils tested.
Extra Benefits: Fine finish and close tolerance

25% to 40% increase in tool life...

AFTER CHANGE TO SAFCO KOLD KUT 525

Stretched-out tool life for this one concern—using Safco Kold Kut 525, a semi-base, general-purpose oil—is typical of hundreds of case histories in the Swan-Finch files. The advantages achieved in each case are directly traceable to this important factor: a specific oil recommendation based upon a study of the individual materials, operations and machines used.

No catalog-selected oil can be as *tailor-made* to your needs as a Swan-Finch cutting oil selected by an expert.

With assurance of a correct survey—backed by 95 years experience—you can have a Swan-Finch man look over *your* plant operations. His recommendation for a better Swan-Finch cutting oil will point the way to the advantages others are already achieving.

No cost... no obligation... no production stoppage is connected with his short visit. Call in the Swan-Finch expert or write for new bulletin, "Metal Working Lubricants".

SWAN-FINCH OIL CORPORATION

CHICAGO • DETROIT • NEW YORK

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3702

SPECIAL MACHINES BUILT TO ORDER

We have specialized in building machines and parts to our customers' drawings for 36 years. Send your blueprints for prompt estimates.

HARTFORD SUPER-SPACER *Special*

for JIG BORING WORK...

Here the Super-Spacer is demonstrating another of its advantages to any tool room. Equipped with a face plate for exact location of work, it can be used on your jig borer to save indexing time, *and* production cost per piece. The Super-Spacer takes milling, drilling, grinding, planing, slotting, boring and other operations in stride. Investigate its benefits to your shop. *Write Dept. S2.*

HARTFORD *Special*

THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD 5, CONN.

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills—and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

WRITE today for Catalog No. 16

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

SELLEW KOST KUTTERS

Will greatly increase Your
DRILLING OUTPUT

SELLEW "K" type 2 spindle, full ball bearing drill head with spiral gears completely enclosed for smooth operation, complete with ¼" capacity chucks, minimum adjustment between spindles 1⅜", maximum 3¾".

Also can furnish special fixed center heads to your requirements, with spindles (any number) in straight line, circular or staggered formation. *Send us your drilling requirements.*

Sellew Machine Tool Co., Inc.
PAWTUCKET, R. I.

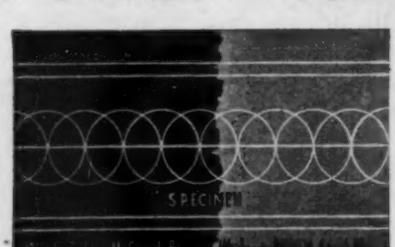
Inc. 1910

Drill Head Specialists for over 35 years

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



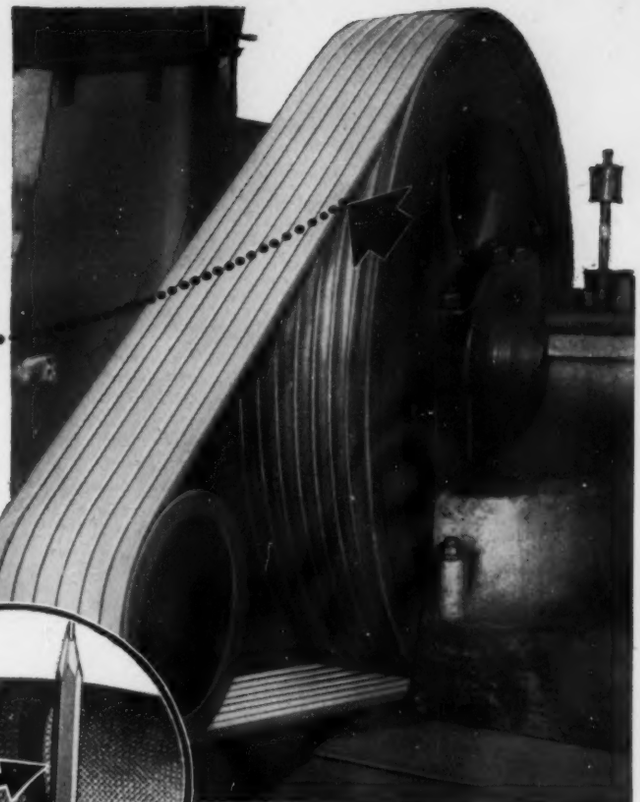
Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301B North 11 St., St. Louis, Mo.
In Canada: 2466 Dundas St. West, Toronto, Ont.

THE Sides OF A V-BELT ARE WHAT Grip the Pulley, Pick-up the Load AND REALLY Get the Wear!

Diagram of V-Belt in Sheave-Groove



Every ounce of load a V-Belt carries must *first* be picked up by the *sides* of the belt. Clearly so, because *only* the *sides* come into contact with the pulley! The sides do all the *GRIPPING* on the pulley. They get all the wear against the sheave-groove wall. The sides *pick up* the load. They transmit that load to the belt as a whole. And then, once more, the sides—and the sides *alone*—grip the driven pulley and *deliver* the power to it.

That is why you have always noticed that the sidewall of the ordinary V-Belt is the part that wears out first.

THAT'S WHY THE Concave Side (A GATES PATENT) IS IMPORTANT TO YOU!

Clearly, since the sidewall is the part that wears out first, anything that prolongs the life of the sidewall will lengthen the life of the belt—and that's why the patented Concave Side is important to you.

The simple diagrams on the left below show exactly why the ordinary, straight-sided V-Belt gets excessive wear along the *middle* of the sides. They show also why the Patented Concave Side greatly reduces sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

and the CONCAVE SIDE is more important NOW than ever before!

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Fig. 1
Straight Sided V-Belt
Fig. 1-A
How Straight Sided V-Belt Bulges When Bending Around Its Pulley
You can actually feel the bulging of a Straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.
Fig. 2
Gates V-Belt with Patented Concave Sidewall
Fig. 2-A
Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt is Bending Over Pulley.
No bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

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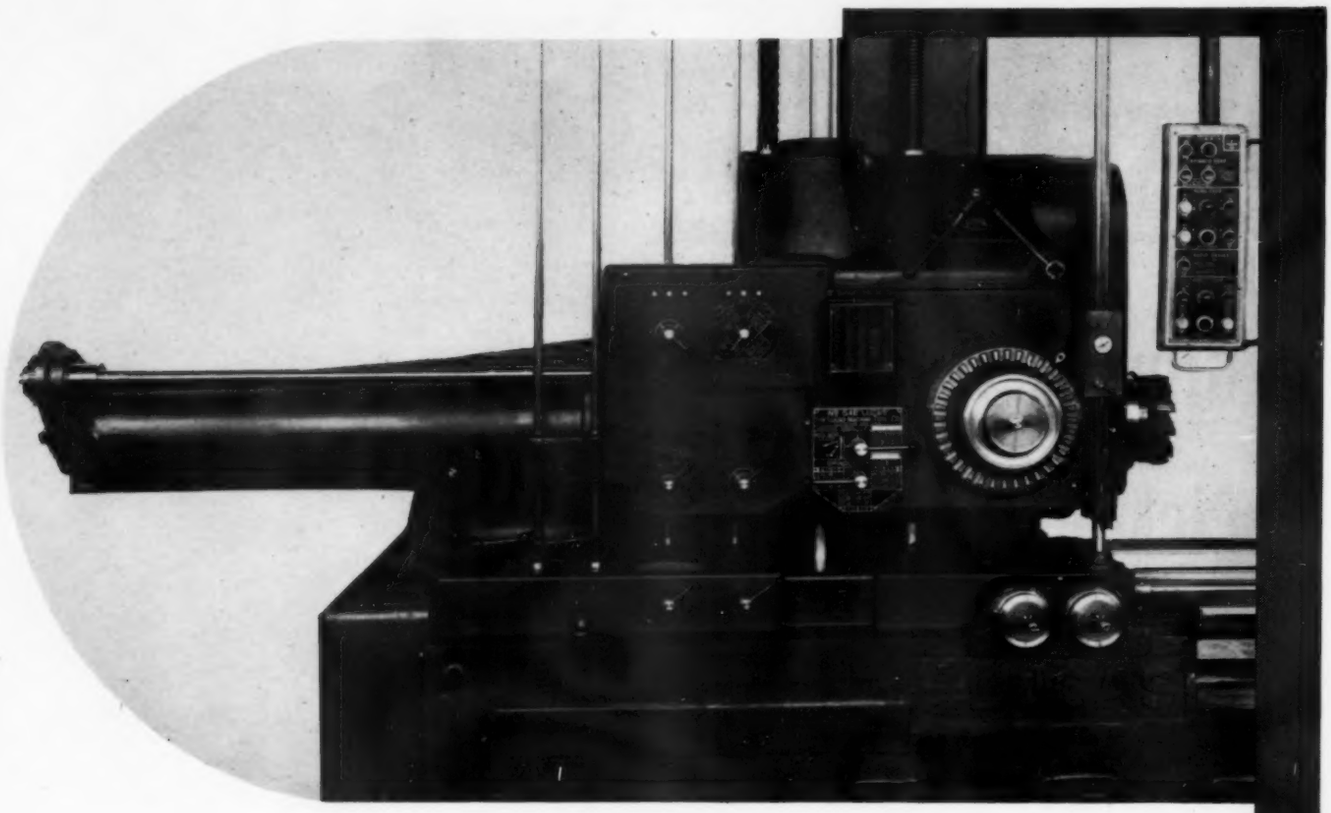

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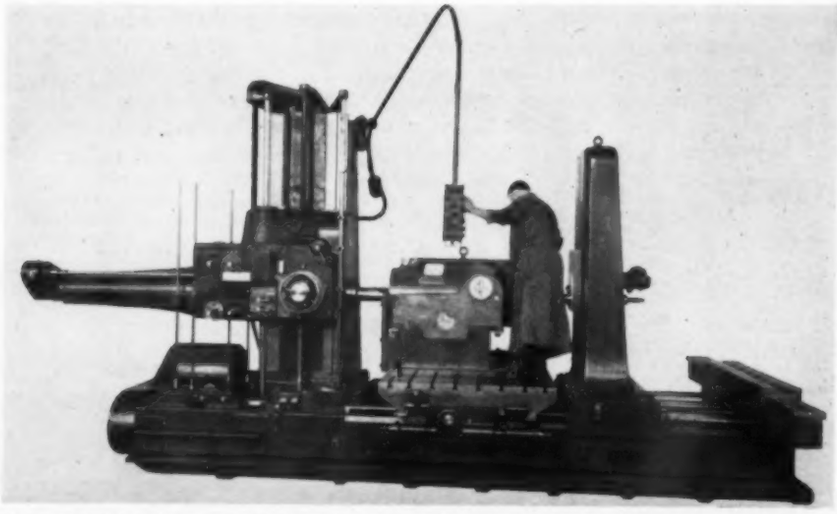

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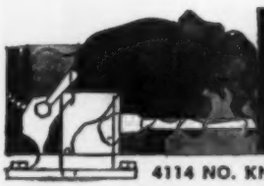

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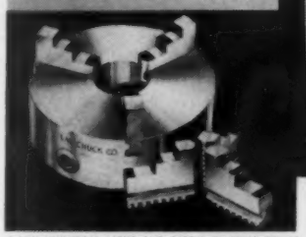

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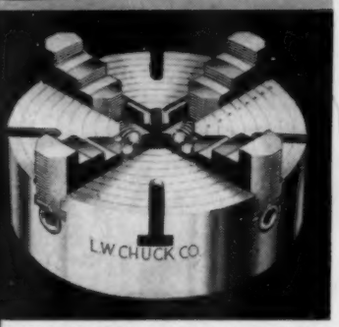

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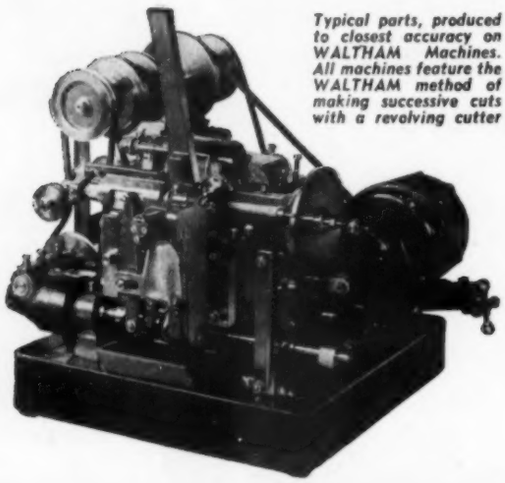

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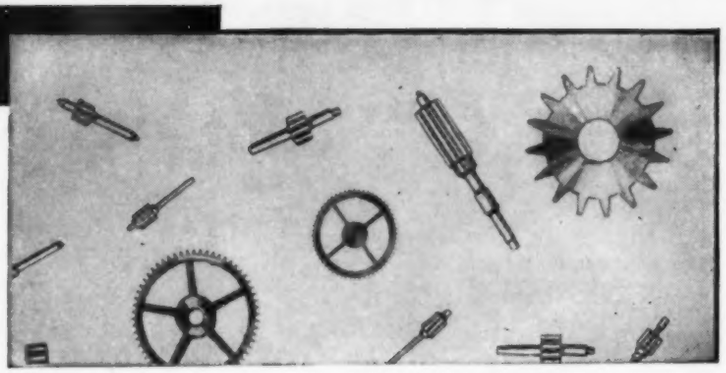

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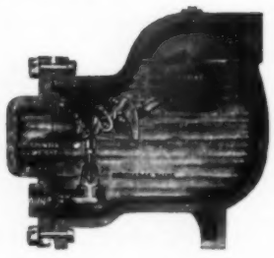

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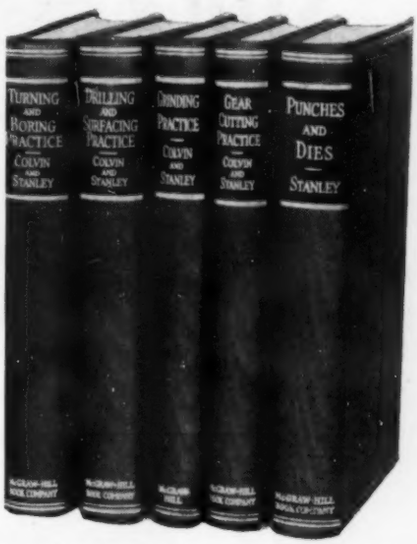

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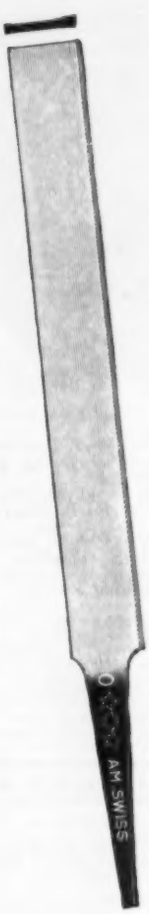

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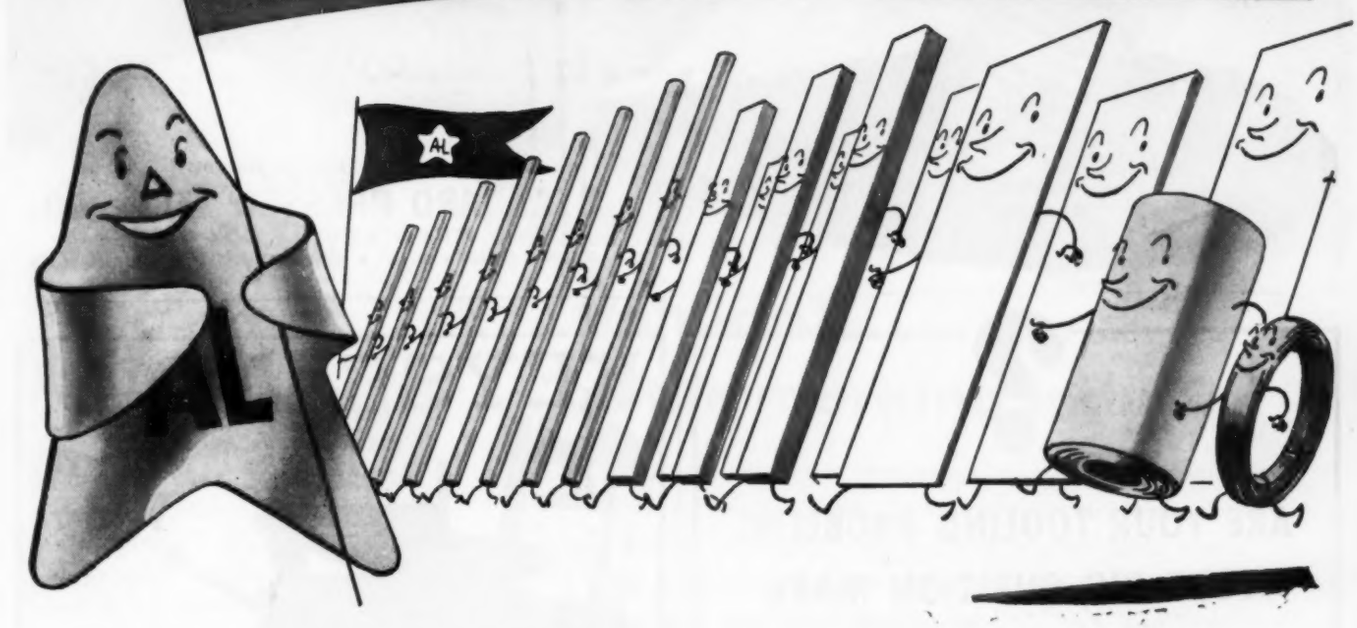

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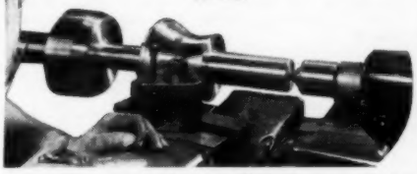
General foreman of Republic Flow Meters Co., Chicago: "Ideal Live Centers give us greater turning speed and have helped increase production 15% to 25%. They save both grinding time and lubricating time."

Says FRED HUER
Machinist at Republic plant: "Ideal Live Centers improve the quality of the work. They eliminate chatter, center lubrication, and burned out centers."



In scores of plants the story is the same: Ideal Live Centers mean better work at lower cost. No friction between the center and the work—no burning or gouging—deeper cuts and faster turning speeds. Ask for information and free demonstration.

Ideal Male type Live Center. Female and Pipe type Centers also available from stock.

Also Heavy Duty Live Center—built to carry heavy loads. Accurate to .0005.

IDEAL INDUSTRIES, Inc.
5076 Park Avenue
SYCAMORE, ILLINOIS

IDEAL

Distributed Through
AMERICA'S LEADING WHOLESALERS
Canadian Distributor: Irving Smith, Ltd., Montreal

standard of the marking industry

Noblewest automatic numbering heads are the product of long experience and guaranteed to be the finest obtainable. Produced from specially selected steel, each part is precision made by master craftsmen in a plant equipped with every modern facility. Such standards of quality pay dividends in long service and precision numbering to every user. Standard models are available in any size numbers from 1/40" to ½". Special numbering heads are made to any requirements including embossing heads, and numbering heads combined with dies. For complete specifications, prices, and other details write to NOBLE & WESTBROOK MANUFACTURING CO., 17 Westbrook St., East Hartford 8, Connecticut.

MARK IT BEST WITH
NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

CONTRACT WORK

Tools • Dies • Jigs • Fixtures • Stampings
Molds • Forgings • Special Machinery • Devices
Parts • Screw Machine Products • Castings

KAMIS Engineering Company

Designers & Manufacturers of Tools & Machinery

Special machine work; facilities available for production quantities of small, medium and large machined parts, assemblies and fabrications. Specializing in stainless steel avaiation gas turbine parts.

Send for Brochure No. 3 which describes our facilities in detail.

300 MOORE STREET
PHILADELPHIA 48, PA.

ALMA WANTS YOUR BUSINESS

- Job Machining
- Production Machining
- Automatic Screw Machining
- Heat Treating—Welding
- Tools—Jigs—Fixtures—Gages
- Special Machinery
- Designing—Engineering
- Parts—Made to Order in Volume
- Products Wanted—To Manufacture
- Accurate Work—Prompt Delivery

CONFIDENTIAL HANDLING OF ALL INQUIRIES

ALMA MOTOR COMPANY
OFFICE: 1434 NATIONAL BANK BLDG.
DETROIT 26, MICHIGAN
Telephone: Woodward 5-0643

SCREW MACHINE SPECIALISTS

- 1/32" to 1⅛" Dia. Cap.
- Brown & Sharpe Automatics Acme-Gridley Mutiple Spindle Automatics
- Hand Screw Machines
- Equipped for All Secondary Operations
- Send Prints or Samples for Prompt Quotations

C. H. HOPPER MACHINE CO.
1935 UNION RD.
GARDENVILLE, N. Y.

Very best facilities for

STAMPINGS

IN SMALL LOTS

DAYTON ROGERS
Manufacturing Company
Minneapolis (7), Minn.

Experience has taught that having Harmon manufacture your parts, or assemble your finished product will pay you dividends.

If you have any type machine work to be done, you will find that Harmons trained personnel and quality control of all operations will produce better results at a lower cost.

Equipment lists will be furnished on request.

HARMON
MACHINE CO., INC.
225 WEST LEWIS, WICHITA 2, KANSAS

We Specialize in
—A-L-U-M-I-N-U-M—
If you have quantity parts to be MACHINED — POLISHED — ANODIZED *we can do it. Send for samples*
White Engineering Works, Inc.
Stamford, Conn.

THREAD GRINDING
Accurate Lead *Send Print*
Universal Thread Grinding Co.
579 Lafayette St., Bridgeport, Conn.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them.
GENERAL PATTERN WORKS
2233 Burk Street Cincinnati, Ohio

CONTRACT
CENTRELESS GRINDING
Of Cemented Carbide Rod and Small Parts
KING GEM COMPANY
Gallatin Gateway, Montana
Precision Jewel Bearings to Specifications since 1938

SEARCHLIGHT SECTION

(Classified Advertising)

"Opportunities"
Employment : : Equipment
Business : : Used or Resale

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Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.

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Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION VACANT

CHIEF DRAFTSMAN: To take charge of six to eight draftsmen in an Eastern Pennsylvania manufacturing plant. Experience in general drafting, supervision, and designing of castings, machined parts and stampings for steam specialty products. Reply stating education, experience and salary requirements to P-3772 American Machinist.

SELLING OPPORTUNITY OFFERED

CUTTING TOOL Salesmen. New type end mill. Sells easily all shops. Must have allied lines. Excellent territories open. SW-3445, American Machinist.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500 and up. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (38 years recognized standing and reputation). The procedure, of highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Particulars on request. R. W. Bixby Inc., 266 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ENGINEER WITH 25 years experience, including chief engineer and manager, in design, developmeent and manufacture of chemical, food stuffs, special and hydraulic machinery, desires position in small company, with particiipation preferred. PW-3593, American Machinist.

EXECUTIVE ENGINEER desires connection with medium size company to assume full responsibility as production manager, plant superintendent or chief engineer. 25 years of unique practical, design and manufacturing experience. Specialist in manufacturing of automatic machinery, instruments, tools, fixtures, precision gears. Thoroughly familiar with engineering and developing new products, purchasing, assembly, inspection, cost control, budget planing, plant engineering, labor relations, contract negotiations. Capable organizer with excellent record to get things done. Age 45. College Graduate M.E. Only permanent position considered. PW-3686, American Machinist.

CHIEF INSPECTOR available A1 record 25 years of diversified experience quality control, methods, tools, machining. Technical H.S. grad. Sincere, efficient supervisor. PW-3708, American Machinist.

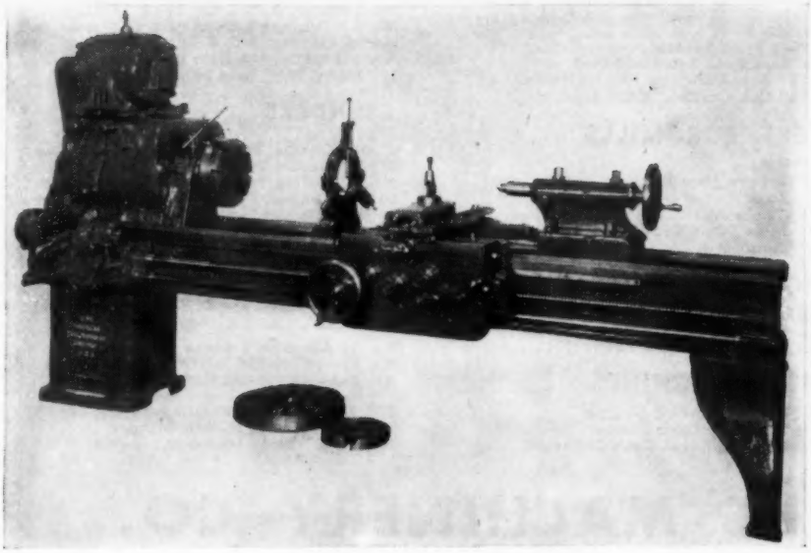
Additional Employment, Business Opportunities and Auction Advertising on page 301.

BUY FROM STOCK
Telephone
MAIN 6347-6348

FALK
MACHINERY COMPANY

18 WARD ST.
ROCHESTER 5
N. Y.

Every Item Guaranteed as Represented



American Q.C.G. Selective Geared Head, 18"x10', Actual swing over ways—20", max. centers—72", Taper Attachment and 3/60/220/440 volts motor drive.

ENGINE LATHES

32"x28' Bridgeford, Geared Head
32"x16' Bridgeford, Geared Head
28"x10' Davis, Quick Change Gear
26"x18' Bridgeford Geared Head
24"x36' New Haven, Motor Drive
24"x22' Lodge & Shipley, Geared Head
24"x18' American Q.C.G. Grd. Hd. 11' centers, Taper Attach. Motor Dr.
24"x12' Putnam, Quick Change Gear
24"x10' LeBlond, Quick Change Gear
20"x11' Schumacher-Boye, Q.C.G.
20"x10' American, Q.C.G.
20"x10' Hendey, Q.C.G motor dr.
20"x8' Lodge & Shipley, Q.C.G. M. Dr.
18"x10' American Geared Head
18"x10' Davis, Q.C.G. M. Dr.
18"x8' Lodge & Shipley geared head
18"x8' Hendey Q.C.G. 49" centers
18"x7' Lehman, Q.C.G. M. Dr.
18"x6' American, Geared Head, MD.
16"x8' Hendey, Q.C.G. M. Drive
16"x6' Lodge & Shipley Geared Head
14"x8' Rockford, Q.C.G. Collets
14"x8' Pratt & Whitney, Q.C.G. Collets
14"x6' LeBlond, Q.C.G. M. Drive
14"x6' American, Q.C.G. M. Drive
14"x6' Mulliner-Endlund, M. Drive
14"x6' Hendey, Q.C.G. M. Drive
14"x6' Rockford, Q.C.G. M. Drive
13"x5' South Bend Q.C.G. 30" centers
12"x30" American, Wood Spinning
12"x5' Sidney, Geared Head
12"x5' Hendey, Q.C.G. M. Drive
12"x5' Sebastian Q.C.G. Grd. Hd. 30" Centers, Taper Attach. Motor Dr.
12"x3' Craftsman, Bench, M. Drive
11"x4' Sidney, Q.C.G. Floor Type
11"x4' South Bend Q.C.G. 20" centers
11"x3' South Bend, Q.C.G. M. Drive
10"x24" Logan, Q.C.G. (new) in stock
9"x12" Sundstrand Mfg. Type
8"x18" Rivett Precision, Bench
9"x15" Porter-Cable, Production

TURRET LATHES

Morey #2 Geared Head, 1" Cap.
Simmons, Microspeed, 1" Cap.
W-Swasey, Univ. #4, 1½" Cap.
Gisholt #4, Univ. 2" Cap.
W-Swasey #2A, Univ. 2½" Cap.
Gisholt #5, Univ. 2½" Cap.
W-Swasey #3A, Univ. 3½" Cap.
Bullard 42" Vert. Turret

PARTIAL LISTING
SEND US YOUR
INQUIRIES

POWER PRESSES

Clearing 200 Tons, S.S. 10" Stroke
Michigan O.B.I. 36 Tons Cap.—2" Stroke
General 8 Tons, Flexible Power Press, M. Dr., Arranged for motor dr.
Ferracute #EG52 Geared Coining Press, 150 Tons Cap.—Up Moving Ram
Baxendale O.B.I. 11 Tons, 1½" Stroke
Zeh & Hahneman, Single Action Cam Press, Spring Return Type—35 Tons Capacity, Arranged for motor dr.

DRILLING MACHINES

Natco #12, 20 Spdles. 3/16" Cap.
Natco #D6, 24 Spdles. 5/16" Cap.
Natco #D5, 14 Spdles. 5/16" Cap.
Fox #15, 54 Spdles. #1 m.t.
Minster #2D, Sgle. Spdle. Upright, compound table, #5 m.t., heavy duty
Cinci.-Bickford, 3½' arm, 9" col. Radial
Cinci-Bickford, 4' arm, 11" col. Radial
Cinci-Bickford, 5' arm, 13" col. Radial
Fosdick, 5' arm, 14" col. Radial
Cinci-Bickford, 6' arm, 15" col. Radial

SHAPERS & PLANERS

Pratt-Whitney Vert. Shaper, 6", M. Dr.
Logan 7" Horiz. Shaper, Motor Drive
Machinery Sales 16" Crank Shaper
Gould & Eberhardt 16" Crank Shaper
Gould & Eberhardt 24" Crank Shaper
American 24" Crank Shaper, Motor Dr.
New Haven 12" Vertical Shaper
Whitcombe, 24x24x6 Planer
Niles-B-P, Shaper Planer, 20x20x24
Ingersoll Planer Type Mill 30x30x16
Betts, 120"x72"x35' Planer
Ingersoll Planer Type Mill, 30x30x12

AUTOMATICS

#0 & #00 Brown & Sharpe Full Automatic, Standard Speed
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle
1—#515 National Acme 9/16" 4-spindle Automatics, complete

LATHES

8"x15" Sundstrand, Model D
10"x22" Sundstrand, Model AA
12"x18" Lipe Carbo
15"x5' Sebastian
14"x6' Hendey
16"x33" Fay Automatics (1942)
18"x6' American
20"x10' Lodge & Shipley
20"x25" Fay Automatics (1942)
22"x48" Centers Monarch (1942)
36"x30' Lodge & Shipley
36"x48"x16' Lehman Hydrotrol (1945)
30"x17' cc LeBlond (1942)

MILLING MACHINES

No. 2H Milwaukee Vert. (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Standard Milwaukee Vert.
No. 3 Cincinnati Vert. High Power
No. 3K Milwaukee Vertical (1942)
24" Cincinnati Production
No. 1-18 Cinn. Mig. (1940)
No. 2-18 Cinn. Rise & Fall (1941)
No. 2—16" Sundstrand Electromil (1942)
No. 4-48 Cinn. Hyd. Tracer (1942)
No. 5-48 Cinn. Hyd. (1942)
No. 45-48 Cinn. Plain Hydromatic (1942)
No. 45-48 Cinn. Hyd. Duplex Tracer (1943)
No. 45-48 Cinn. Hyd. Plain Tracer (1942)
No. 56-90 Cinn. Hyd. (1943)
No. 2 Hanson-Whitney Thread
4"x9" Hanson-Whitney Univ. Thrd. Miller
4½"x12" Pratt & Whitney, Model C
6"x20" Pratt & Whitney, Model C
6"x36" Lees-Bradner—Model HT (1943)
12"x54" Lees-Bradner—Model HT (1943)
4" Taylor & Fenn Spline, M.D.
Ingersoll Traveling Column Miller
24"x24"x12' Ingersoll Adj. Rail
54"x36"x10' Ingersoll Adjustable Rail
72"x48"x12' Ingersoll Adjustable Rail

ReMANUFACTURED MACHINE TOOLS
(ORIGINATED BY US)
Reg. U.S. Patent Office

DRILLS

No. 121 Baker
No. 217 Baker—(1943)
No. D-8 Colburn No. 6 M. T.
No. 3MS—24"—1 Spdl. L.G.
No. 2LMS—20"—2 Spdl. L.G.
No. 2LMS—26"—2 Spdl. L.G. (1945)
No. 2LMS—26"—4 Spdl. L.G.
24"—4 Spdl. Demco
No. 2—8 Spdl. Leland-Gifford
7'-15" Col. American Full Universal
7'-15" Col. Carlton, Motor on Arm

VERT. BOR. MILLS

34" King
42" Bullard New Era
52" King
72" Cincinnati
72" Niles Extra Heavy
84" Betts

HOR. BOR. MILLS

Rockford, 3½" bar
No. 360-F Giddings & Lewis (1942)
No. 560-F Giddings & Lewis (1942)

GEAR MACHINES

No. 4—48" Brown & Sharpe
No. 7 Fellows Gear Shaper
11" Gleason Bevel Gear Cutter

MISCELLANEOUS

Model H-7 Micromatic Vert. Honer
2500 Ton Lake Erie Hydraulic Press
No. 22-C Racine Shear Cut Hack Saw

TURRET LATHES

No. 2 B. & S. Screw Machine, Wire Feed
No. 601 Oster Rapiduction (1942)
No. 3 Jones & Lamson (1942)
No. 3 Bardons & Oliver, Bar fd. (1942)
No. 4 Gisholt (1942)
No. 5 Warner & Swaseys (1942)
No. 5 Bardons & Olivers (1942)
No. 5 Foster, A.C. & Bar Feed (1942)
No. 2-A Warner & Swasey
No. 6R Denver, A.C. & Bar feed
No. 1-H Libby, 6¼ Hole in Spindle (1937)
18" Libby, 3½" hole in spindle

GRINDERS

4"x12" Landis Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"x36" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motor Driven Plain Grinders
6"x18" ——— to ——— 24"x240"

10"x24" Landis Type C Universal
12'x36" Landis Type LCH Universal (1945)

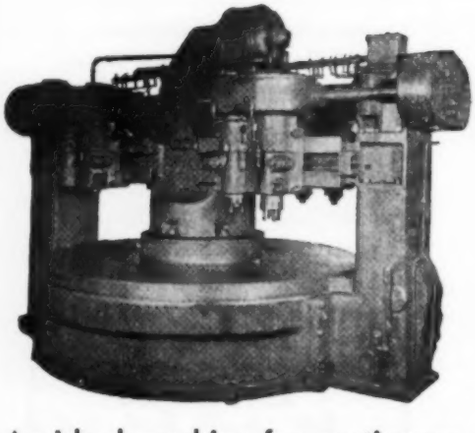
No. 34 Abrasive Surface (1943)
No. 22—12" Heald Rotary Surface (1943)
No. 25A—24" Heald Rotary Surface (1943)

72A-3 Heald Internal Grinder
10"x72" Colonial Broach Grinder
No. 5—18" Besly Disc Gdr.

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BLVD. CHICAGO 6, ILL.

Newton Type V-4 Continuous Rotary Milling Machine



Equipped with 2 double heads, and 2 single heads, diameter spindle sleeves 6⅝" complete with 25 H.P. motor.

An ideal machine for continuous production of cylinder blocks, bases and a multitude of similar parts.

EMERMAN MACHINERY CORP.

875 W. 120TH ST. CHICAGO 43, ILL.

UNUSUAL VALUES

Milling Machines—#1, Universal, #1 American (new) plain, #1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe #3—26", Gould & Eberhardt 42".

Grinders—Cylinder B & S #11, Planer type 16"x36", Surface 13"x62", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6' 8', 10'—16"x6', 8', 10'—18"x6', 8', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.

Large stock 19" and 12" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24", B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 36", 40".

SPECIAL—New totally enclosed, dust proof, fan cooled, ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted top (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt #25—24" Hi Duty. 3" capacity in steel, motor attached.

PATTERN MAKING MACHINERY—12"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.
P. O. BOX 88, COLUMBUS 16, OHIO

LATEST TYPE NEARLY NEW MACHINES

AUTOMATIC SCREW MACHINE

BROWN & SHARPE #4, 1½" capacity, latest type
GOSS & DeLEEUW 6"x6¾", 4 spindle chucker Latest Type
NATIONAL ACME 9/16, 5 spindle, Model D, MD

BORING MILLS—Horizontal

DETRICK & HARVEY 4", 5" bar, Floor Type, M.D.
EXCELLO #2112A, #112C single end, 2 spindles, Borers, latest type
GIDDINGS & LEWIS #32, 3¼" bar, M.D.
GIDDINGS & LEWIS #25 2½" bar, M.D.
HEALD #46B, #48A, #49 single and double end Borers, latest type
LUCAS #31, 3" bar, motor drive
LANDIS #35 3¼" bar; Floor Type
NILES BEMENT POND 4¼" bar, Motor Drive
NILES BEMENT POND 5", 6", 7" bar, floor type
P & H #10 3½" bar, floor type, M.D.
UNIVERSAL 3" bar, high speed, latest type

BORING MILLS—Vertical

BETTS 120", 2 swivel heads, AC, M.D.
BETTS (Consolidated) 84"—3 heads, AC, latest
BULLARD 36" Vertical Turret, spiral drive, high column, Lateest Type
BULLARD 16" 6-spindle Type D Multimatic; latest type
BULLARD 24", 36" vertical turret, M.D., New Era
COLBURN 72" 2 swivel heads, AC/M.D.
KING 36" Vertical Turret, M.D., Latest Type
KING 42", 2 swivel heads, Latest Type
NILES 73", 100", 2 swivel heads, PRT; M.D.

BROACHES

LaPOINTE #4L Horiz. Hyd., latest type
LaPOINTE SRV-10-54, Vert. Surf. Hyd., latest
LaPOINTE #3, Horizontal M.D.

DRILLS—Multi. Spindle

BAUSH #4 Adj. multiple spdl., M.D.
BODINE 42 20, 42 30, Latest Type
FOOTE BURT 20 spindles, latest type
KINGSBURY 4 spindle Model GC, latest type
NATCO D5, adjustable multiple Latest Type
PRATT & WHITNEY #12 Adj. multiple spdl., M.D.

DRILLS—Sensitive

ALLEN #1, #2, #3, latest type
AVEY #2, #MA6, 1, 2 & 3 spindle, latest type
BARNES #H3 Hydram, heavy duty, hydraulic, latest
BUFFALO #4, latest type
EDLUND #1B, #2B, #2MS, 1 to 3 spindles, latest type
FOOTE-BURT #2, #3, single spindle, latest type
High Speed Hammer #B 53, Latest Type
LELAND-GIFFORD #2MS, 2 spindles, latest

DRILLS—Radial

AMERICAN 5'13", plain, motor drive
CINCINNATI BICKFORD 6'15" plain or uni. M.D.
DRESES 5'13" plain or universal, motor drive
FOSDICK 5'14" motor drive
FOSDICK 6' arm 19" column, Economax, Hyd., Latest
NILES 6' Universal, motor drive
WESTERN 5'18", 6'20", latest type

GEAR CUTTING EQUIPMENT

BARBER COLMAN Type S Hobber, Latest Type
BARBER COLMAN No. 3 hobber—latest type
BARBER COLMAN #12 Hobber, Motor Drive
BROWN & SHARPE No. 3H gear cutter, M.D.
FELLOWS #615A, #61, #645A3, #7A, #72, #75A, #77 High Speed Gear Shapers; latest type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #6Z2 Gear Shaper; high speed; latest type
FELLOWS #13LS Lapper, latest type
GLEASON 3", 12" straight bevel generator, Latest
GLEASON 10", 15" Spiral Bevel Generator, md
GLEASON #20 Spur Gear Tester, Latest
GLEASON 11", 18" Straight Bevel Generator, md
GLEASON #7 Spiral bevel, hypoid, Zerol, Latest Type
GLEASON 36" Straight Bevel Planer, M.D.
GLEASON #4, #6, #13, #18 Bevel and Hypoid Tester
GOULD & EBERHARDT #12H, #36H, Hobbers, latest type
PFAUTER #1, #2 with diff., M.D.
PRATT & WHITNEY 10" Grinder, hyd., latest

GRINDERS—Cyl.—Plain & Univ.

BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
BROWN & SHARPE #20 10x18 plain, latest type
CINCINNATI 6x18 plain Model EA, ER, hyd., latest
LANDIS 6x18, Type C, hydraulic, latest
LANDIS 30"x220" centers, motor drive
NORTON 16x72 Univ., hyd., Type C Latest
NORTON 16x72 Plain Type "C", latest type

GRINDERS—Miscellaneous

BARBER COLMAN #3 Hob sharpener; latest type
BROWN & SHARPE #13 Universal & Tool; latest type
BRYANT 5, 6, 16-16, 16-CP-16, 24, Internal, Latest Type
BRYANT #5, #16-16, #16-CP-16, Internal, Hyd. latest
CINCINNATI #2, Centerless; latest type
CINCINNATI #2 Universal Cutter & Tool; latest type
CINCINNATI #3 Centerless, Motor Drive
COVEL #91A Universal Cutter and Tool, Latest
FITCHBURG 14"x25" Spline, hydraulic, latest
GLEASON #12 Tool Sharpener, Latest Type
HEALD #50 Internal, Hydraulic, M.D.
HEALD 75A, 72A3, 81 Internal; latest type
HEALD #50, 70, Internal, Motor Drive
HEALD #72A3 SIZEMATIC, M.D.
JONES & LAMSON 6x15, 8x48, Automatic Thread Grinder, latest
OLIVER #510 Drill Grinder, latest type
SELLERS #30W Drill Grinder, latest type

GRINDERS—Surface

ARTER 8" Rotary, Motor Drive
ARTER Automatic ring, Motor Drive
BLANCHARD #16, 24" chuck, M.D.
BLANCHARD No. 16A—Dial Type—motor drive
BLANCHARD #27-18 M.D., Latest Type
BLANCHARD #11, 16"; latest type
G. & L. #35, 8x24, hyd., Latest Type
G. & L. #55, 12x36 hyd., latest type
HANCHETT #300 series, vertical 13x48, latest type
HEALD #22 Rotary, 12" chuck, latest type
HEALD #25A Rotary, 16" chuck, hydraulic, latest type
MATTISON 12x16x60 hydraulic, latest type
MATTISON 14x16x60 hydraulic, latest type
MATTISON 20x24x72" Hyd. Latest Type
NORTON 6x18 Hydraulic; latest type
NORTON 10x36 hydraulic, latest type
PRATT & WHITNEY 8" Rotary, M.D.
THOMPSON 8x12x24 hydraulic, latest type
THOMPSON 16x30x48 hydraulic, latest type

LATHES—Engine and Mfg.

BETTS BRIDGEFORD 60x14' Centers, (raised to swing 84') PRT, AC/M.D.
BRIDGEFORD 36"x28', 36"x32' bed—2 carriages
HENDEY 12x54" Centers, Motor Drive
JONES & LAMSON (FAY) 20x25 Centers, Auto. Timken, Latest Type
LeBLOND 17x5', 20x10' Bed, Timken, Rapid Production, Latest Type
LEHMANN 16x30" centers, TIMKEN, latest type
LODGE & SHIPLEY 16/30x30" centers, Timken, Latest
LODGE & SHIPLEY 18x72" centers—Motor Drive
LoSWING 4x60, 4x84, 8x60, 8x108, 5x34, Latest Type
MONARCH 12x30" centers; Timken; latest
MONARCH 16x28" centers; geared-head, M.D.
MONARCH 10"x20" centers, Model EE, Timken, latest
N.B.P. 48x32' centers, 2 carriages, PRT, M.D.
N.B.P. 48x63' centers, 87' centers, combination turning and boring, M.D.
NILES 42"x60" double head, motor drive
NILES 48x35', centers, heavy Duty, 2 carriages, Timken Bearing, PRT, Latest Type
NILES 60x10' centers, heavy duty, PRT, Latest Type
NILES 60x35' centers, heavy duty, 2 carriages, PRT, Latest Type
NILES 72"x62' centers, combination Boring and Turning, Motor Drive
NILES 30x50' Boring, Timken, Latest Type
PRATT & WHITNEY 1/2B 30", 2 spindle, Deep Hole
REED PRENTICE 16x24" centers, geared head, M.D. Drill, latest
SPRINGFIELD 14"x6' bed, geared head, M.D.
SPRINGFIELD 16"x6' bed, geared head, M.D.
SUNDSTRAND 8x15 Style D, Automatic, Stub, latest
WARD HAGGAS & SMITH 18/30x66" Centers GAP, Latest Type

LATHES—Turret

BARDON & OLIVER #5, 7, Universal, Timken, Latest Type
CINCINNATI ACME No. 1, No. 5W, Timken, Latest
GISHOLT #3, #4, #5 Univ. Timken Bearing, Latest
GISHOLT #1L, #2L, Universal, Timken, Latest
JONES & LAMSON #3, #7C, #8A Univ., Timken Bearing; latest type
LIBBY No. 1H-5 Timken Bearing—latest—5⅛" hole
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
POTTER & JOHNSTON 5D2E, Automatic, Timken, latest
WARNER & SWASEY 3A, Univ., 6" hole, bar or chucking, Timken Bearing, Latest Type
WARNER & SWASEY #1A, #4A Univ., Timken; latest

MILLING MACHINES—Mfg.

CINCINNATI 24", 48" duplex, TIMKEN, M.D.
CINCINNATI 3-24 Duplex, Hydromatic, Timken, Latest
HALL Style D, Planetary, latest type
INGERSOLL 32x24x16' Planer Type, 2 heads, AC, M.D.
INGERSOLL 42x38x12' Planer Type, adjustable rail, 4 heads, AC/M.D.
INGERSOLL 32x30x12' combination Planer and slab, Motor Drive
PLAN-O-MILL #3 latest type
SUNDSTRAND Model 3A Duplex, latest type
TAYLOR & FENN M80 Duplex Spline, latest

MILLING MACHINES—Plain

BROWN & SHARPE #12 Timken Bearing, Latest Type
CINCINNATI #4 Dial Type; Timken, latest type
CINCINNATI 0-8 Automatic rise and fall, Timken Bearing, Latest Type
CINCINNATI #4 Timken Bearing, M.D.
CINCINNATI #48, Motor Drive
CINCINNATI 1-12, TIMKEN, latest type
KEARNEY & TRECKER 1218, TIMKEN, latest
KEARNEY & TRECKER #4 Heavy, Timken, M.D.
KEMPSMITH #2, #4 Maximiller, Timken, latest type
LEBLOND #4 heavy duty, M.D.
SUNDSTRAND #2 Electro Mil, Timken, Latest

MILLING MACHINES—Universal

AMES Bench, M.D., latest type
BROWN & SHARPE #3A, motor drive
CINCINNATI #3 Universal, Dial Type, Timken, latest
HARDINGE Model UM, Timken, latest
KEARNEY & TRECKER #3H, Timken, latest
VAN NORMAN #12, 22L, Timken, Latest Type

MILLING MACHINES—Vertical

BRIDGEPORT High Speed, Latest Type
CINCINNATI #2, #3, #4 Dial Type; Timken; latest
CINCINNATI No. 3, No. 4 High-Powered, M.D.
GORTON 8D superspeed, latest type
GORTON 9J, with duplicator complete, latest
REED PRENTICE #5 die sinker, latest type
REED PRENTICE 3VG with Hydraulic Duplicator, Timken Bearing, Latest Type
SUNDSTRAND Model 3A Rotary, Latest Type

PLANERS

CHANDLER 36x36 20', 4 heads, AC, M.D.
DETRICK & HARVEY 48x48x16', 4 heads, Hyd.
DETRICK & HARVEY 84"x84"x18'; 4 heads; DC; Motor Drive
GREY 36x36x8' Maximum Service, 2 heads, DC/M.D.
NILES BEMENT POND 48x48x16', 4 heads, AC, M.D.
OHIO 42x42x20'—2 heads, AC, M.D.

PRESSES

BIRDSBORO 325 Ton Vertical Hyd., Latest Type
CLEARING Type DS 1125 32 Double Action, 125 ton, Latest Type
FERRACUTE DG 55, 75 ton, drawing, Latest Type
GLEASON 15" Quenching, Motor Drive
NILES 200 ton, Horizontal Wheel, M.D.
WATSON & STILLMAN 20 ton, Hyd. Straightening, Latest

SHAPERS

CINCINNATI 26" Travel Head—2 head type B
LAMAIRE 18' Vert. Hydraulic—latest type
MOREY 8", 10", 12", 14" Vertical, latest type
MORTON 48" draw cut, M.D.
NEWTON 15" vert. slotter, DC, M.D.
NILES 18" vert. slotter, DC, M.D.
ORMEROD 8" Vertical, latest type
PRATT & WHITNEY 6", 10" Vertical, M.D.

MISCELLANEOUS

BAKEWELL #1 Tapper; motor drive
BARNES #172, Vertical Hone, latest type
BIGNALL & KEELER #8, 2½"-8" capacity, Pipe threader, Latest Type
BILLINGS & SPENCER 1500 lb. Board Drop Hammers
CLEVELAND 12"x16" Centers Cutter Reliever, M.D.
GISHOLT 3U Dynetric Balancer, latest type
LANDIS 1" Bolt Threader, Latest Type
MARVEL #6A Hack Saw, latest type
NAZEL #4B Pneumatic Hammer, M.D.
PRATT & WHITNEY 1A, Jig Borer, Motor Drive
PRATT & WHITNEY 3B Jig Borer; latest type
PRATT & WHITNEY (KELLER) Type G Copying; latest type
PRATT & WHITNEY (KELLER) Type BL-2416 Copying, latest type 2 or 3 dimensional

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MACHINE TOOLS—*Subject to Prior Sale*

DRILLS

3'11" CANEDY-OTTO — RADIAL — 220/3/60/1800 — LATE TYPE — 1942 Mfg.

3'9" AVEY — Sensitive — RADIAL — Belt Drive.

GRINDERS

#2 CINCINNATI — Tool & Cutter — 220/440/3/60 — Universal — Large assortment of accessories — LATE TYPE.

7"x11" LEACH — Plain Cylindrical — M.D. — 220/3/60 LATE TYPE — 1942 Mfg.

6"x18" MONARCH — Surface — Hand feed — XLO mtzd. Spdle — 550/3/60 — with chuck.

#3B ABRASIVE — Surface — Mfg. 1942 — back last eliminator — BB — cross ways

#60 HEALD — Cylinder.

10"x14" MAJESTIC — Cylindrical — 220/3/60 — mtzd. work head — mtzd. wheel head pump — piping — LATE TYPE — 1943 Mfg.

10"x24" NORTON — Cam Grinder — Mtzd.

#13 BROWN & SHARPE — Universal — Tool & Cutter — Wet, attachment — Cabinet — Lg. assort. of access. — LATE TYPE — 1942 Mfg.

6"x32" NORTON — Plain Cylindrical — MD — 220/440/3/60.

#70 HEALD — Internal — 220/3/60 — MD.

LATHES & TURRETS

20"x54" REED-PRENTICE — 16 speed — Geared Head — Taper Attach. — 220/440/3 — with additional equipment — LATE TYPE — 1942 Mfg.

14"x30" LODGE & SHIPLEY — 12 speed — motor in base — TA — chuck — steps — 4 way tool post — 220/440 — other equipment — 1941 Mfg.

14"x6' HENDEY — Geared head — factory MD — chucks — less mtr.

16"x6' HENDEY — QCG — Taper attachment — Chuck — Collets — MD.

#5 JONES & LAMSON — Universal Turret — LATE TYPE — 1943 Mfg.

#2 WARNER & SWASEY — PF to turret— Cross slide — BD — arr. MD.

#3 WARNER & SWASEY — Universal Turret — late type — chucking

14x8' Monarch — Engine — BG — Chuck, collets, motorized, Turner drive

MILLING MACHINES

#2 BROWN & SHARPE — Plain Horizontal — Light Type — Mfg. 1943

#3K K&T "Milwaukee" Plain Horizontal — Power rapid traverse — 220/440/3/60 — motor in base — LATE TYPE — 1943 Mfg.

#3H K&T "Milwaukee" Plain Horizontal — Power rapid traverse — 220/440/3/60 — motor in base — LATE TYPE — 1942 Mfg.

#2K K&T "Milwaukee" Plain Horizontal — Power rapid traverse — 220/440/3/60 — motor in base — LATE TYPE — 1943 Mfg.

#34 OHIO — "Osterlein" — Universal — Belt drive — New dividing heads.

#2—24 CINCINNATI — Rise and fall — LATE TYPE — 1942 Mfg.

#3H K&T "Milwaukee" — VERTICAL — Power rapid traverse — Powder feed to head — Motor in base — LATE TYPE — 1942 Mfg.

#2H K&T "Milwaukee" — VERTICAL — Power rapid traverse — Power feed to head — Motor in base — LATE TYPE — 1942 Mfg.

#5 BECKER — Vertical — Belt drive — Motor bracket — 12x48" table.

#1 United States — Hand — complete 220/440 late type — 1942 Mfg.

SAWS

#4C COCHRANE-BLY — Cold — Inserted tooth blade — MD — 220/3/60.

SCREW MACHINES

#2 BROWN & SHARPE — hand — wire feed — late type

#00G BROWN & SHARPE — Fully automatic — Vertical slide attachment — Serial No. 7580.

#00G BROWN & SHARPE — Fully automatic — Serial No. over 11,000 — Motor driven slotting attachment — Swing step and equipment — LATE TYPE.

#R4 NATIONAL ACME — 4 spdle — Fully automatic — 3½" cap. — 220/440/3/60 — complete assortment of equipment — LATE TYPE.

#0 BROWN & SHARPE — Fully automatic — Belt drive.

#R NATIONAL ACME — 4 spdle — Fully automatic — 1⅝" cap. — LATE TYPE — Extra equipment.

2" GREENLEE — 6 spdle — Fully automatic — Motor driven — LATE TYPE — 1942 Mfg.

SHAPERS

28" AMERICAN — Back geared — Power feed to head — Single pulley drive.

32" GOULD & EBERHARDT — Universal — "Industrial" — Heavy Duty — Late Type — Mfg. 1942.

24" GOULD & EBERHARDT — Crank — Motorized with 4 speed drive.

7" LOGAN — Floor type — 110/1/60 — NEW.

16" Steckbridge Crank backgeared CD — with vise

SHEARS

36" PEXTO—Power squaring—Motor drive—16 ga.

42" WHITNEY — Power squaring motor drive — 220/3/60 — 16 gauge — NEW.

MISCELLANEOUS

PLANER — Woodward & Powell — 30"x30"x12' — 2 rail heads — 2 side heads — Down feed and elevation — Box bed — BD.

PLANER — Whitcomb — 24"x24"x6' — Arr. for motor drive — Less elec. equip. — 1 rail head.

Boring Mill — Universal — 3" bar — horizontal — MD — 220/3/60.

GEAR CUTTER — Henry Reuson — #6 — 72" spur.

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34 HERMAN STREET — WORCESTER 8, MASS.

LATEST TYPE Pratt & Whitney

14" x 60" HYDRAULIC VERTICAL SURFACE GRINDER

Like New

OTHER FINE MACHINE TOOLS AVAILABLE

60"x27' Centers Niles Lathe
60"x15' Centers N-B-P Lathe, 1942
12"x30" Monarch Lathe, taper, collets, 1942
2—#2H Milwaukee Universal Millers, 1944
#2H Milwaukee Vertical Miller, 1942
#3A, #4 Warner & Swaseys, Timken Brg.
#32 Lucas 3¾" Horizontal Boring Mill.
13—#2 Kent 6"x19" Surface Grinders, 1943
#11 Blanchard Rotary Surface Grinders, 1943
#13 Brown & Sharpe Universal Grinder, 1943
10"x36" Norton "C" Hydr. Grinder, 1942
2—6"x30" Norton "C" Hydr. Grinders, 1942

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SEMI-HIGH SPEED CENTER DRILLS $1.50 PER DOZEN NET ANY SIZE

	Dia. Body	*Dia. Drill*	*Length Overall*
SIZE C-2	13/64"	1/16"	1⅞"
SIZE D-1	15/64"	5/64"	2"
SIZE E-1	3/10"	3/32"	2⅛"
SIZE E-2	3/10"	⅛"	2⅛"
SIZE F-1	7/16"	5/32"	2¾"
SIZE F-2	7/16"	3/16"	2¾"
SIZE J-1	1/2"	7/32"	3"
SIZE J-2	1/2"	9/32"	3"

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CAnal 6-5575

EASTERN MACHINE TOOLS

REBUILT TO FACTORY STANDARDS OF ACCURACY

50"x204" centers LeBlond Lathe

ENGINE LATHES

12"x84" centers Lodge & Shipley Selective Head, m.d., taper
13x30" centers Pratt & Whitney Model B Geared Head, m.d., taper
13x48" centers Pratt & Whitney Model B Geared Head, m.d.
14"x30" centers American "Pacemaker", m.d., latest
14"x30" Lodge & Shipley Selec. Head, m.d., latest
14"x6' bed Hendey Geared Head, m.d., taper
14"x6' Pratt & Whitney, cone
14"x6' Sidney Geared Head, m.d.
14"x8' Pratt & Whitney, cone
15"x6' LeBlond Geared Head, Timken, m.d., late
16"x30" centers Lodge & Shipley, m.d., latest
16"x36" centers Pratt & Whitney Geared Head, m.d., taper
16"x54" centers American Geared Head, m.d., taper
16"x6' Bradford, cone, taper
16"x6' Hendey Geared Head, m.d., taper
16"x6' Lodge & Shipley Selec. Head, m.d.
16"x6' Monarch Geared Head, m.d.
18"x30" centers American Geared Head, m.d. in base
18"x7' Hendey Geared Head, m.d., taper
18"x8' American Geared Head, m.d., taper
18"x8' Bradford, cone, taper
18"x8' Champion, cone
18"x8' Greaves-Klusman, cone, taper
18"x8' Hendey Geared Head, m.d., taper
18"x8' Lodge & Shipley, cone
18"x12' LeBlond, cone
19"x10' LeBlond Geared Head, m.d.
21"x18' LeBlond, cone
22"x70" centers Greaves-Klusman Geared Head, m.d., taper
22"x8' Lodge & Shipley, cone
23"x12' LeBlond Geared Head, m.d., taper
24"x10' American, cone, taper
24"x10' Greaves-Klusman Geared Head, m.d., taper
24"x10' Hendey Geared Head, m.d.
[illegible] Lodge & Shipley, cone
[illegible] LeBlond, cone
24"x12' Reed-Prentice Geared Head, m.d., taper
24"x14' Boye & Emmes, cone, taper
26"x16' Boye & Emmes, d.c. m.d., taper
30"x12'6" Niles-Bement-Pond, m.d., taper
36"x12' Lehmann Hydratrol Geared Head, m.d., taper, latest
36"x21' centers Putnam Geared Head, m.d.
36"x30' Lodge & Shipley Selec. Head, m.d.
36"x32' centers Putnam Geared Head, m.d.
36"x36'6" bed Niles H.D., m.d., geared head latest
50"x204" centers LeBlond H.D. Geared Head, m.d., taper, latest

SAWS

6x6" Peerless Hack Saw, m.d.
6x6" Racine Hack Saw, s.p.d.
13x13" Peerless Universal Shaping Saw, m.d.
No. 3 and 8 Nutter and Barnes Cold Saws
No. 6 Cochran-Bly Cold Saw
No. 13B Espen-Lucas Cold Saw
Gustav Wagner Cold Saw, m.d., 28" blade
7½ H.P. Cincinnati Elec. Tool Co. type JCAW Abrasive Cut-off Machine

TAPPING MACHINES

No. 1 Bakewell, m.d., latest
No. 2 Bakewell Precision, m.d., latest
No. 10 Kaufman Hi Duty Oscillat. Pneu., m.d., latest
No. 5 Webster & Perks 5 spindle Vertical Nut, cone

TURRET LATHES

No. 1 Cincinnati Acme Semi-Universal, m.d., chucking
No. 1 Cincinnati Acme Semi-Universal, m.d. bar
No. 1L, 2L, 3L Gisholt, m.d., Timken Bearings, hardened ways, standard length and extra long bed types
No. 1A, 2A, 3A Warner & Swasey Universal, m.d., plain bearing types, bar and chucking machines
No. 2A, 3A Warner & Swasey Universal, m.d., Timken Bearings, covered ways, bar and chucking machines
No. 1A Warner & Swasey Universal, chucking, m.d., pre-selector head, latest
No. 3A Warner & Swasey Universal, chucking, m.d., latest
No. 2 Cincinnati Acme Full Universal, m.d., chucking, latest
No. 2 Pratt & Whitney Shaver, m.d.
No. 2 Warner & Swasey All Geared Head, m.d., latest, bar
No. 2B Foster Universal, m.d., chucking
No. 2G Morey Ram Type, m.d., bar
No. 3 Cincinnati Acme Full Universal, chucking, cross sliding turret
No. 3 Cincinnati Acme Full Universal, chucking
No. 3 Foster Geared Head, m.d., bar
No. 3B Foster Universal, m.d., bar
No. 3 Warner & Swasey Universal, m.d., bar, latest type
No. 3 Warner & Swasey as above, chucking
No. 4 Gisholt Universal,, m.d., Timken, chucking
No. 4 Warner & Swasey Universal, m.d., chucking
No. 4 Warner & Swasey Universal, m.d., chucking, pre-selector head, latest
No. 4 Warner & Swasey as above, bar
No. 4 Warner & Swasey Plain, cone, motorized, bar and chucking types
No. 4A Warner & Swasey Universal, m.d., chucking, 8" hole, latest
No. 4A Warner & Swasey Universal, m.d., chucking, 7½" hole, Timken
No. 4R Cincinnati Acme, m.d. in base, bar
No. 5 Foster All Geared Head Universal, m.d., chucking
No. 5 Jones & Lamson Universal Ram Type, m.d., chucking, latest
No. 5 Warner & Swasey Universal, m.d., chucking, pre-selector head, latest
No. 7 Bardons & Oliver Geared Head, m.d., bar
No. 7 Bardons & Oliver, motor in head type, chucking, late
2½" Jones & Lamson Universal Saddle Type, bar, late
2½x24", 3x36", 3½"x32", 4x34" Jones & Lamson Geared Head, m.d., bar and chucking types
3¼" Cincinnati Acme Geared Head, m.d., chucking
18" and 26" Libby Turret Lathes, m.d.
16", 20" Acme Turret, cone
24" and 28' Gisholt, cone
No. 5 Woods Tilted Turret, cone

UNIVERSAL CYLINDRICAL GRINDERS

No. 1 Brown & Sharpe Self-Contained, m.d., late
12x24" Cincinnati Self-Contained, m.d.
No. 2—12x30" Brown & Sharpe, belt
12x30" Landis Hydraulic Universal, m.d, late
12x36" Cincinnati Self-Contained, m.d.
12x36" Cincinnati, belt
12x48" Cincinnati Hydraulic, m.d., latest
12x48" Norton Hydraulic, m.d., latest
16x48" Cincinnati, belted m.d.
18x48" Cincinnati Hydraulic, m.d., latest

PLANERS

36"x36"x10' Cincinnati, 3 heads, belted m.d.
24"x24"x6' Bray, 1 head, belt
24"x24"x10' Whitcomb-Blaisdell, 2 hds, belted m.d.
30"30"x10' Gray, 2 heads, belt
30"x30"x14' Gray, 2 heads, belt
32"x32"x16' Gray, 2 heads, belt
36"x36"x10' Niles, 2 heads, belt
36"x36"x18' Niles-Bement-Pond, 2 hds, revers. m.d.
36"x36"x20' Cincinnati, 2 heads, belt
36"x36"x20' Gray, 2 heads, belt
36"x38"x20' Gray Spiral Drive, 2 heads, belt
42"x42"x26' Gray, 2 heads, belted m.d.
48"x48"x12' Gray Open Side, 1 rail head, 1 side head, reversing m.d., late
48"x48"x18' Detrick & Harvey, 4 hds, revers. m.d.
48"x48"x28' Cincinnati, 4 heads, reversing m.d.
48"x48"x30' Cincinnati, 4 heads, m.d.
48"x48"x32' Niles-Bement-Pond, 4 hds. revers. m.d.
48"x48"x40' Sellers, 2 heads, reversing m.d.
56"x42"x10' Cincinnati, 4 heads, m.d.
62"x62"x40' Cincinnati, 4 heads, reversing m.d.
66"x60"x40' Niles-Bement-Pond, 4 hds, revers. m.d.
72"x72"x24' Niles-Bement-Pond, 4 hds, revers. m.d.
72"x72"x36' Niles, 4 heads, reversing m.d.
96"x72"x18' Pond, 4 heads, belted m.d.
Type P10 Coulter Shaper Planer, m.d.

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
Nc. 1A Milwaukee, Plain, m.d. in base
No. 1M Cincinnati, m.d.
No. 1½, 2 Cincinnati, cone
No. 2B Brown & Sharpe, m.d., latest
No. 2HL Milwaukee, m.d., latest
No. 2L Cincinnati, m.d.
No. 2 Cinn. High Speed Dial Type, m.d., latest
No. 2MH Cincinnati, m.d., latest
No. 3S Cincinnati, s.p.d.
No. 3K Milwaukee Dial Type, m.d.
No. 3 LeBlond, cone
No. 3 Oesterlein, cone
No. 4 Cincinnati H.P., m.d.
No. 5B Heavy Brown & Sharpe, m.d.
No. 5 Cincinnati H.P., rect. overarm
No. 5 Heavy LeBlond, s.p.d.

VERTICAL MILLING MACHINES

No. 2M Cincinnati, m.d.
No. 2, 3, 4 Cincinnati H.P., m.d.
No. 2 Cinn. Medium Speed Dial Type, m.d., latest
No. 2, 3, 4 Cincinnati H.S. Dial Type, m.d., latest
No. 2HL Milwaukee Swiveling Head, m.d., latest
No. 2H, 4H Milwaukee Dial Type, m.d., latest
No. 2K, 3K, 4K Milwaukee Dial Type, m.d., latest
No. 2½B Milwaukee, s.p.d.
No. 3 Cincinnati Medium Speed Dial Type, m.d.
No. 3B Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 3V Van Norman, m.d., latest
No. 4 H.P. Cincinnati, m.d., feed in knee
No. 4 Kearney & Tracker, fixed head type, m.d.
No. 5 Brown & Sharpe, cone
No. 5 Jackson, m.d.
No. 5 Reed-Prentice, m.d., circular table, 1942
No. 6 Becker, cone
Cincinnati Hydromatic with 2 vertical spindles on rail

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BORING MILL—Betts 112" 2 heads 1943
BRAKES —New Barth Hand 8 ' x 16 G
New Lynn Hydraulic 56" x 14 G
New Columbia 10 ' x 3/16" (45 days)
D & K 8 ' x 16 G Apron Power
SHEARS —New Foot 36" to 96"
New Barth Power 52" x 72" x 14 G
Pexto Power 30" & 60" x 16 G
Geo. Ohl 8 ' x 12 G Power
New Columbia 10 ' x 3/16" (45 days)

SAWS —DoAll Contour 16"
Newton Cold Cut 32" x 12" diam.
TURRET —W & S #4 Univ. Preselect, bar (1942)
WELDERS —New Sterling up to 50 KVA
LATHE —Pattern Makers 18" x 12 '
PRESSES —New Famco Power Presses 4½ & 7½ ton
New Famco Foot #10

POWER PRESSES 50 Miscellaneous Presses up to 30 Ton

MAKE	TONS	STROKE	DIE SPACE	TYPE
Torrington	50	2" & 1"	23" x 16"	Sub-Arch Press, Dble Action Cam
Toledo No. 54	60	3"	18" x 18"	SS with side shear
Bliss No. 5	90	5"	22" x 30"	SS Single Action
(4) Bliss No. 6	125	5" & 2"	24" x 32"	SS Dble or Single Action, b.g.
Bliss No. 3¾ Toggle	150	10½" Draw	30" x 29"	Toggle, b.g.
Bliss No. 7	180	5" & 2"	28" x 36"	SS Dble or Single Action, any Stroke up to 5", b.g.
(2) Clearing (F1200-42)	200	26" & 30"	38" x 44"	SS Single Action, b.g.
(2) Bliss No. 77½	250	12" & 14"	30" x 29"	SS Single Action, b.g.
(3) Bliss No. 78½	450	18"	36" x 36"	SS Single Action, b.g.
Toledo No. 60¼	1200	23½"	59" x 50"	SS Single Action, b.g.
Birdsboro Hyd.	1300	21"	87" x 29"	SS Hydraulic

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AVAILABLE FOR IMMEDIATE DELIVERY

#3 Waterbury-Farrel punch press, capacity 20 ton stroke 2½", ram adjustment, 60 strokes per minute, shut height, 6½", bed size F to B 10½", R to L 14½".....$475.00

#6600 Waterbury-Farrel punch press, cap. 56 ton, vertical back geared, open back, straight sided stroke 6", 60 strokes per min., 20" shut height, distance between uprights —46", bed size 10"x45", 5 HP motor, push button switches, V drive.....$1750.00

#PG-6 Ferracute Punch Press geared 1¾" stroke, bed area R to L by F to B 34¾x23. Opening in bed R to L by F to B 16x14. Slide adjustment. Height overall 103".....$2750.00

Van Norman Horizontal Milling Machine with 2 direct drives. Milling heads motorized, serial number 11065.....$642.00

#5 Waterbury-Farrel blanking & cupping press.....$380.00

#35P Toledo punch press, gap type, flywheel 48"x7", bed size 27"x18", stroke 1¾", 15" from bed to bottom of rain ways, motor rack, not motorized. Pitman strap and eccentric just rebuilt.....$1500.00

Model RA-6, six-spindle Acme-Gridley automatic, 9/16" bar cap., including tooling and equipment, serial #22377A, practically new.....$3950.00

Spot welder, 75 KVA gun type with air control, model S1DS5, serial #2801, Progressive.....$650.00

Hayes Electric Heat Treat furnace type HG64, Serial No. 3496 with controls.....$350.00

#5 Long & Allstatter Gate Shear, shear blades 42"x3½"x⅞" shearing capacity ½" thick copper.....$950.00

BILLARD MACHINE & TOOL CO.
PHONE 44 MANSFIELD, PA.

PRESSES

STRAIGHT SIDE—60 ton, 5" stroke, 48x24 bed, late model Waterbury Farrell (15).

90 ton, 8" stroke, 50x18 bed, Bliss (3), 42'
200 ton, 32" stroke, 27x27 bed, Bliss, 43'
#56 Toledo, 4" stroke, 21x21 bed, 15½" shut height.
35 ton, 4, 5, 6" stroke, latest type, pract. new, w/all accessories, Bliss $850.00 ea.
70-85 ton, 4" stroke, 21x27 bed, 110 strokes per min., Bliss, latest type.
90-125 ton, 4½" or 5½" stroke, 60, 80, 110 (optional) strokes per min., latest type.
INCLINABLE—#21 ½A Bliss, brand new, w/ cushions, 6" stroke, 18" shut height (3).
55 ton Walsh, brand new, 3½" stroke, 9" shut height.
15 ton, new $363.00; 4½ ton, new $165.00.
35 ton, Toledo Herning, 2" stroke.

AUTOMATICS

1⅝" Acme Gridley, 6 spdl. latest type (2).
2¼" Cone, 6 spdl., latest type (4).
16" 8 spdl. Bulard Multaumatics, pract. new, $9000.00 ea. (5).

Horiz. Boring Mills Table Type, late design.
5" Sellers, 84x48 tbl., 72" vert. trav. spdl.
5" Giddings & Lewis, 84x48 tbl, 60" vert. trav.

BRAKE

10'x½" Henderson Power Press Brake, 30 HP motors and controls. Just taken out of operation.

SPOT WELDERS & BUTT WELDERS

Prompt delivery, 5 to 300 KVA, Brand new, guaranteed.

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Detroit 8, Michigan
TYLER 7-6300

MDNA MEMBER

Bor. Mill Hor. 3" G & L. M.D.
Boring Mills, 24"-36"-42"-52"-72"-96"
Drills, Radial 3"-4"-5"-6" Cin.-Bick.
Lathe, Turret 3-A W. & S., S.P.D.
Millers, Plain No. 3 K & T. No. 4 Cin.
Millers, Vertical No. 3 B & S & No. 4 Cin.
Profiler, #13 P. & W., B.D.
Shapers, 16"-20"-24"-36".
Shaper, 36" Morton Draw Cut.

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361 Atlantic Ave., Boston, Mass.

No. 00G B & S High Speed Automatics
No. 2G B & S High Speed Automatics
Model B Davenport Automatics

MDNA MEMBER

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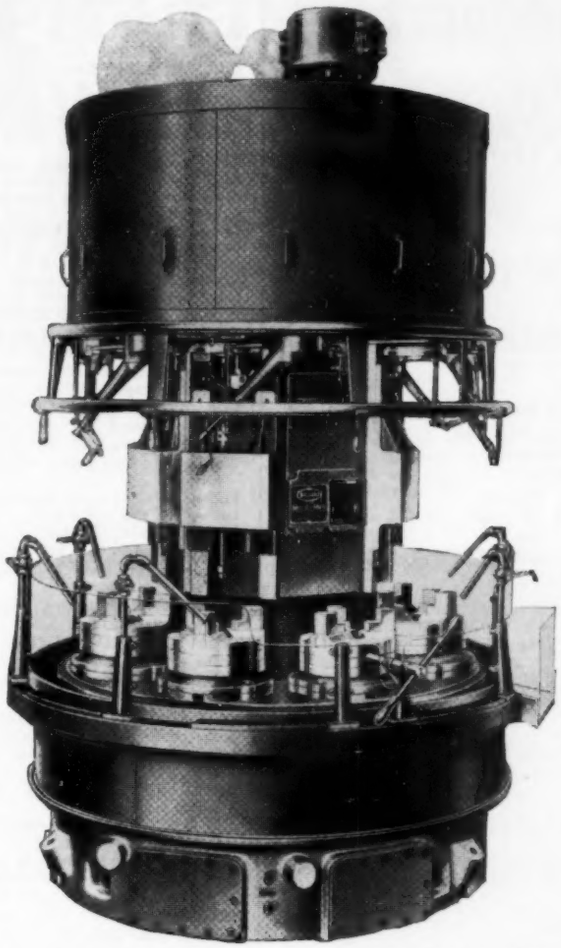

Bullard Mult-au-matic, 16″ Type D, six spindle, single index, with four plain vertical heads and one double purpose head; complete with motors and controls. Late model.

AUTOMATICS

2G Brown & Sharpe, H.S. 1½″ capacity. New in 1943.
9/16″, 1″ & 2⅝″ RA-6 Acme-Gridley. New in 1943.
1⅝″—8 spindle Conomatic. New in 1942.
5½″ Cleveland Model A, single spindle.
16″ x 33″ Fay Automatic Lathe. 1941.

BROACHES

No. 28L LaPointe Hydraulic Horizontal. New in 1942.
No. CPC 6-36 LaPointe Hydraulic Vertical. New in 1943.

DRILLS

4′ 11″ Carlton Radial. New in 1943.
6 Ft. American radial 17″ column.
★ No. 26HO Baker Hydraulic, single spindle, 3″ capacity in steel, with motor and control. Latest type.
42″ Cincinnati-Bickford, single spindle.
No. 3 Avey, three spindle, heavy duty.
No. 3 Baush Multiple Spindle.
Barnes Horizontal Deep Hole, 2 spindle.
Taft Peirce Horizontal, double end.

GEAR CUTTERS

No. 16H Gould & Eberhardt Universal Hobber. Latest type.
No. 7A, 7125A Fellows Gear Shapers.
No. 615A, 645A, Fellows Gear Shapers.
No. 12 Barber Colman Hobber.

GRINDERS

No. 2 & No. 3 Cincinnati Centerless, Filmatic spindle. 1941.
14″ x 48″ Cincinnati Universal, Filmatic bearing, internal spindle. New in 1942.
10″ x 36″ Landis Hydraulic. New in 1943.
6″ x 18″ Cincinnati Hydraulic, Filmatic spindle. New in 1943.
No. 3 Brown & Sharpe Universal. New in 1943.
No. 18 Blanchard, 30″ chuck. 1942.
14″ x 16″ x 60″ Mattison Surface.
6″ x 18″ Thompson Surface Grinder. New in 1942.
16″ x 48″ Thompson Surface Grinder. New in 1943.
No. 75A Heald Internal. New in 1943.
No. 72-A-3 Heald Sizematic. New in 1943.
★ No. 74 Heald Internal Grinder, with 6 foot extension on bed for long work, adjustable work headstock on swivel table for long tapers.

LATHES, ENGINE

American Pacemaker, 16″ x 30″.
Lodge & Shipley 20″ x 48″. New in 1943.
★ Bertram 28″ x 240″ "Timesaver", two carriages, with rapid traverse. Canadian made from Niles patterns. 1942.
Lodge & Shipley 48″ x 54″, cone driven.
Carroll Jamieson 18″ x 5′, C.D.
LO-Swing, IMP & LR.
South Bend 14½″ x 6′, c.d.
Lipe Carbomatic, 15″ x 30″.
LeBlonde Production, 17″ x 30″.

LATHES, TURRET

Warner & Swasey No. 4A.
Warner & Swasey No. 2A, preselector. New in 1943.
Warner & Swasey No. 1A, preselector. New in 1940.
Gisholt No. 1L, hydraulic speed selector. New in 1943.
Warner & Swasey No. 5 Universal. 1943.
Gisholt No. 5 Universal, Hydraulic speed selector. New in 1944.
Foster No. 5 Universal, Bar feed. 1943.
Warner & Swasey No. 4 Universal, preselector. New in 1943.
Gisholt No. 4 Universal, Hydraulic speed selector.
Warner & Swasey No. 3 Universal, two speed. New in 1942.
Bardons & Oliver No. 3 Universal, motor in base. New in 1941.
Warner & Swasey No. 2, oversize. 1942.
Bardons & Oliver No. 2 bar feed. 1941.
Brown & Sharpe No. 1, M. in B. 1941.
★ Bullard New Era VTL, 36″ x 42″.

MILLS

Cincinnati No. 2MH Universal. New in 1942.
Van Norman No. 2SU Universal.
Gorton No. 9J Vertical, with tracer.
Cincinnati No. 2MH Plain, latest model.
Cincinnati No. 5 Plain. New in 1944.
Cincinnati Vertical, No. 3 Med. S. Dial.
Milwaukee Vertical, No. 2H. New in 1942.
Cincinnati No. 08 and 2-18 Rise and Fall.
Cincinnati No. 1-12 Automatic.
Cincinnati No. 4-36 Hydromatic.
DeVlieg Supermill No. 31B Sundstrand Electromil No. 2.
Whitney Hand Mill, No. 6.
★ 72 Betts Vertical Boring Mill, two heads, DC drive with AC/DC generator. New in 1943.

MISCELLANEOUS

No. 5B Standard OBI Press. New.
No. 7 Kling Punch, 1¼″ through 1″, 72″ throat.
No. 8-6 Zeh & Hahneman S.S. Geared Press.
Pratt & Whitney Profiler, No. 12D.
Tapper, Leland Gifford 3′ Radial, No. 3 MT. New in 1941.
24″ Cincinnati Worm Feed Rotary Table.

PLANERS AND SHAPERS

American Planer, 24″ x 6′, m.d.
Cincinnati Planer, 42 x 42 x 20, D.C.
Cincinnati 20″ Shaper, Universal table. New in 1943.
Cochrane & Bly No. 14 Vertical Shaper. New in 1942.
Pratt & Whitney 6″ Vertical Shaper. New in 1943.

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DRILLS

Avey & Allen 3, 4, 5, & 6 Sp.
Providence 4 Sp. M.D.
Barnes No. 262, No. 201
Cincinnati-Bickford 3', 4', 5', & 6' Radials
C-O—6 Sp. M.D.
Niles-Bement-Pond 6' Radial

GRINDERS

Abrasive Nos. 33 & 34; No. 3B
Norton 6"x18" Hyd. Surface
Norton 6"x10"x36" Surface
Norton 15"x15"x72" Surface
Hill-Acme 18"x24"x96" Surface
Mattison 12"x16"x54" Surface
B. & S. Nos. 1, 2, 3, Universal
B. & S. Nos. 5, 10, 11, Plain; #13
Bryant Nos. 3B, 5, 6, 12 Internal
Cincinnati No. 1½ Tool & Cutter
Cincinnati No. 2 Univ. Tool & Cutter
Norton No. 2 Tool & Cutter
LeBlond No. 2 Tool & Cutter
Cincinnati No. 2 & No. 3 Centerless
Cincinnati No. 3 Centerless Lapper
Fitchburg 36" Spline Grinder
B. & S. No. 13 Univ. & Tool, Late Type
Blanchard No. 16—30"
Heald No. 25-A Rotary Surface
Heald No. 22—12" Rotary Surface
Heald Nos. 70A & 72A Internal
P. & W. 14" Vert. B.B.
Gardner No 5 Disc

LATHES

Monarch 12"x30" CK (swings 18")
Hendey Plain 12", 14", 16", 18" Yoke Head
Hendey 14"x6' Y.H. Fact. M.D.
American 16"x6'—G.H.
Fitchburg 60"x22'
Midland No. 4 Turret
Gisholt No. 3L and No. 5
Bardons & Oliver No. 5 Turret
P. & J. 5D

MILLERS

Milw. No. 3B
Cin. #2 Universal
Milw. No. 2B & 3B Double Overarm
B. & S. No. OY Production
B. & S. No. 3A Universal
Cin. Nos. 3, 4 Vert.
Becker Model C Vertical
B. & S. No. 3B & 5B Plain
Kempsmith #2G Plain
Van Norman Duplex #0, #2, #10, #20
Rice Burton 4" Spline
P. & W. 8", 10", & 12" Automatic
Cincinnati 18" & 24" Production
Sundstrand No 1 18 and No. 2 Electromil
P. & W. 6" x 14" Thread
Lees-Bradner 6"x36" Thread
Cincinnati #5 M.D. Plain
LeBlond 3H Plain
B. & S. No. 12 Production
Gorton No. 9J Vertical
Kempsmith No. 4 Maximiller, Plain

PRESSES

1000 ton Toledo Knuckle Joint
Bliss No. 1½ D.A. Toggle
Ferracute P4
W-F 250-Ton Hobbing
Z&H 80-Ton S.S. (New)

SCREW MACHINES

B. & S. No. 00, 0, 2 Automatic
B. & S. No. 1 & 2 Hand Screw
Cleveland 1⅜" Model AA
W. & S. Nos. 1, 2, 2A, 3A Universal
Foster No. 7 and No. 1B
Cone 1¼" 4 Spindle
Cleveland 3¾" Model A, Latest Type
Cone 3¼"-4 Spindle

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INCORPORATED

National Bent Shank Nut Tappers—Battery of ⅝" and ⅞" Machines.
2 Landis ¾" Bolt Formers and Threaders, M.D.
1 National ½" to 1" Hot Bolt Head Trimmer
Woodward & Powell 42"x42"x36 ft. 4 Head Planer
Cincinnati 36"x36"x16 ft. Planer, M.D.
1 Lodge & Shipley 36" Swing by 44 ft. Bed, Selective Geared Q.C. Lathe, M.D.

National Machinery Exchange
128-138 Mott St., New York 13, N. Y.

LATE TYPE TOOLS

36" Bullard Spiral Drive, 1943 tool
6" bar #360F & #560F Giddings & Lewis Horiz. Floor Type Mills, 1943
No. 2MH Cinci. Univ. Miller, 1944
36"x23' centers & 48"x16' centers Niles Lathes, Both new 1942.
Nos. 2, 3, 4, & 5 W. & S. Univ. Turrets, late
No. 48H Gould & Eberhardt Gear Hobbers
#72-A-3 Sizematic & #72-A-5 Plain Heald Internal Grinders, 1943 (10)
12" Gleason Gear Generators, 1943 (3)
6' Fosdick Radial, 19" col., 1943.

BENNETT MACHINERY CO.
30 Church St. New York 7, N. Y.

MILES' QUALITY

Automatic, 2¾" Acme Gridley RA6
Automatic, 12"x63", 14"x19" & 16"x33" Fay
Broach, Twin 10 & 3XA Oilgear
Broach, 25, 3H LaPointe
Drill, 3'9" & 4'9" Cint. Bick. radial
Drill, 21" & 24" Cint. Bick. upright
Drill, Nos. 11, 14 & 30 Natco multiple
Drill, Nos. 121, 217, 314, 315, 321 Baker
Drill, 24", No. 3 Aveymatic 2 spindle
Gear Hobber, Nos. 3, 12 & Type D Barber Colman
Gear Hobber, Nos. 16HS, 12H & 8H G. & E.
Gear Hobber, No. 5M Adams Mfg.
Gear Hobber, No. 130 Cleveland
Gear Hobber, Nos. 1 & 5AC Lees-Bradner
Gear Shaper, Nos. 7 & 61 Fellows
Grinder, Centerless, Nos. 2 & 3 Cincinnati
Grinder, 6"x18" No. 10 Brown & Sharpe
Grinder, 10"x18" Cincinnati
Grinder, 6"x18", 10"x18" & 16"x36" Landis
Grinder, 6"x18" & 10"x72" Norton
Grinder, 12"x36", No. 2 B. & S. univ.
Grinder, No. 115 Gardner opposed disc
Grinder, Disc, No. 226 Gardner
Grinder, Surface, 10"x24" Norton hydraulic
Grinder, Surface, 12"x48" Thompson hydraulic
Grinder, Surface, 14"x60" Mattison hydraulic
Grinder, Surface, 12", 16" & 24" Heald rotary
Grinder, Surface, Nos. 10 & 16 Blanchard rotary
Lathe, 14"x8' Hendey toolroom
Lathe, 22"x96" Monarch
Lathe, 25"x48" LeBlond
Lathe, 36"x16' bed Bridgeford
Lathe, Turret, Nos. 2, 3, 4, 5 & 1A & 3A Warner & Swasey
Lathe, Turret, No. 3, 4, 5 & 1L Gisholt
Lathe, Turret, No. 2 Cint. Acme saddle type
Lathe, Turret, No. 601 Oster
Lathe, Turret, No. 5 Foster
Lathe, Turret, No. 5 Bardons & Oliver
Lathe, Turret, Nos. 2G & 3 Morey
Lathe, Turret, 24", 36" Bullard vertical
Lathe, Mfg., 14"x18" Monarch Magnamatic
Lathe, Mfg., 6", 8", & 15" Sundstrand auto. stub
Lathe, Mfg., Mod. 10x40" Sundstrand center drive
Mill, 3⅛", No. 0 Giddings & Lewis
Mill, 3½" bar Universal
Mill, 4¾" bar Giddings & Lewis floor type
Mill, 7" Barrett cylinder boring
Mill, Vertical, 53" & 100" Niles-Bement-Pond
Mill, Vertical, 96" Cincinnati
Millers, Nos. 2AS, 3B & 4B Milwaukee plain
Miller, No. 3 Cincinnati universal
Miller, No. 3 Van Norman duplex
Miller, Nos. 3 & 4 Cincinnati dial type
Miller, Nos. 2M, 2, 3, 4 & 4HD Cincinnati vertical
Miller, No. 2H, 3H & 4H Kearney & Trecker vertical
Miller, Nos. 2-24, 3-24, 4-36, 4-48, 5-48, Cincinnati Hydromatic
Miller, No. 33 Sundstrand, 18"x120" table planer type 2 vertical spindles
Miller, No. 12-24" Brown & Sharpe Mfg.
Miller, 30" & 66" Newton rotary
Miller, 30", 42" & 84" Ingersoll rotary
Miller, Nos. 4 & CT36 Lees-Bradner thread
Miller, No. 3 Planomill thread
Planer, 33"x33"x8' Cincinnati
Planer, 48"x48"x12' Cincinnati
Press, Nos. 10, 73½ & 304 Bliss S.S.
Press, Nos. 56 & 56½ Toledo S.S.
Press, 70 ton Verson, cushion
Press, 1000 ton No. 666 Toledo coining
Press, 100 & 200 ton Hydraulic
Roll, No. 18 Kane & Roach straightening
Saw, No. 302 Campbell abrasive
Saw, 42" Tannewitz metal band
Shaper, 6" Pratt & Whitney vert.
Shaper, 12" Whipp
Shaper, 16", 20" & 28" Gould & Eberhardt
Shaper, 20" & 24" Gemco universal
Shaper, 36" Rockford shaper planer
Tapper, No. 1 Bakewell
Tapper, Nos. 2 & 2X Garvin
Upsetter, 1" National High Duty
Upsetter, 1½" Acme

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AARON VALUES IN MODERN TOOLS

MACHINE TOOLS

SPECIALS

Clearing 90-10 Press Brake—10' 10 Ga.

Van Norman #12, 36
Fosdick 24" Sliding Head, Box, Late
56 Ton Thomas OBI Press, New 1947
Gorton Duplicators and Vert. Millers
Gorton No. 3Z, 1D, ME Engravers
Marvel 6A Hacksaw, M.D., Auto, Feed
Injection Moulders, Hydraulic Presses
Norton No. 2 Tool & Cutter Grinder, late
Bakewell No. 1 Tapper
Sellers Wet Drill Grinder 6G, late
Abrasive 6x18, 8x24 Surface Grinders
Cone 1⅞" 8 spindle, Late Type

BORING MILLS

#0 Giddings & Lewis arr. M.D.
2½" Cleveland arr. M.D., 2½", 4" Binsee
Niles-Bement-Pond 4" duplex, Universal 3"
66" Niles; 54" Colburn M.D. 2 hds.
Bullard New Era 24", 42", Vert. M.D.

TURRET LATHES

W. & S. Nos. 3, 4 Grd. Hd., Preselector
Gisholt No. 1L, 2L Univ. M.D., Late
Foster Nos. 4, 5, 6, 1B, 3B M.D. Univ.
J. & L. 2¼"x24", 3¼"x36"
Asme #2 M.D.
Oster 601 Rapiduction, Late
Hardinge ESM, 2nd operation, late

GRINDERS

Abrasive 3B 8"x24" Surf., #34 Vert.
#25 Gallmeyer & Livingston Hyd. Surface
#25A Heald, M.D. like new Rotary Surf.
No. 2 Cincinnati Centerless M.D.
B. & S. No. 2, 2B Surface, M.D.
P. & W. 14", B.B., Vert. Surface 19"x49"
Blanchard 30", M.D.; Modern 12x48" M.D.
Norton Hydraulic 12x18", M.D. Cyl.
Heald No. 72A3 Gagematic
Norton 30"x28' M.D. Roll Grinder
Landis Type A 6x20" Hydraulic, M.D. Cyl.
No. 55, 60, 65 Heald Int., M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 10, 11, Cyl.; 1, 3 Univ.
Norton 6x18", Hyd. Surface, M.D.
Covel #91A Tool, New 1941, Cinn.
Hammond & Excello Floor Model

LATHES

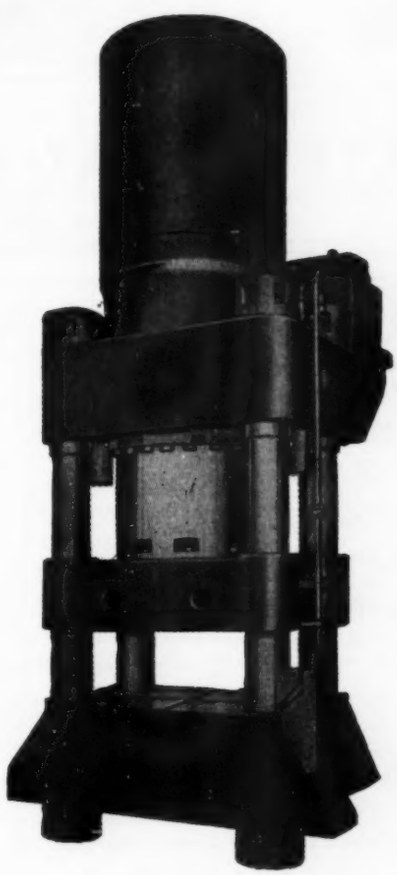
24"x12' Springfield Grd. Hd., late
Monarch, Hendey 12x30, 10x20 G.H. Late
26x12' Boye & Emmes 3 step cone D.B.G.
14"x6' Hendey Taper, Collets 16"x8'
9" LeBlond P&W 1"x18" Automatic
36x30' Putnam M.D., 30x22', 42x16
32"x35' Wickes, M.D.
20"x30' Boye & Emmes Grd. Hd., Late
South Bend, M.D., T.A., 16"x10', 9"x3'
Sundstrand Centering Machine #36, 6"x54"
Sebastian 12"x4' grd. hd. late
Wade, Hjorth, Hardinge, P & W Precision Bench

AUTOMATICS

Cone 8 spindle, 1⅞" Late
Cleveland Model A ⅞", 1¼", 2"; B 1", 2", ⅜"
Cone 4 spindle, Gridley
Brown & Sharpe #4, 6 Auto, #2 Hand

MILLING MACHINES

Cinn. #3 Pl., #4 Vert. Dial Type, Rect.
3B K. & T. Dbl. Overarm
Cleveland Vert. No. 1 M.D.; #1 Univ.
#2B K & T Univ.; No. 2A B & S Univ.
No. 3S Cincinnati, S.P.D. rapid trav.
Nos. 0Y, 2, 3, 4, 5 B & S Plain & Univ.
Hall Planetary Model D Thread Miller
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 2, 3, 4 Cincinnati Vert.
P. & W. No. 12, 30" Profiler, M.D.
B. & S. No. 1, 3 Vert.
B. & S. #12 Elec. Prod. late type, #21
Gorton 8D, 9J, hand feed, Like new
Gorton 8D, 9J power feed, Like new
Gorton 9J Duplicator



1300 Ton Watson Stillman Hydraulic Press

NEW IN STOCK

Power Shears—52", 72" & 96"

Spot & Arc Welders
5, 7, 14, 18 & 30 ton OBI Power Presses
Ammco 7", Shape Rite 8", Shapers
H.S. Vertical Milling Heads
Drill Presses, Foot Presses
Kalamazoo Metal Band Saws
No. 1½ Abrasive Wet Surface Grinder
6x6" Racine Hacksaw; #8 Marvel
20 ton Northern Hydraulic Presses

RADIALS

4' Fosdick 13" col., 8' Carlton, 19" col. M.D.
6' Cincinnati-Bickford
4', 5', 6' American Triple Purpose
Canedy-Otto 3'11" Col. M.D. on Spindle
Walker-Turner, ½" cap.

HYDRAULIC EQUIPMENT

1300 TON
WATSON STILLMAN
HYDRAULIC PRESS
Self Contained

Platen size 48"x42". Stroke 22". Opening 46". Ram Diameter 35". Driven by 50 H.P. motor, also.

600 TON SOUTHWARK PRESS

Self contained 48"x48" platen size, 63" stroke, 110" opening, 50 H.P. motor, 3 phase, 60 cycle, 220v.

1000 TON H.P.M. PRESS

Self Contained

Platen 72"x48". 36" stroke. 36" opening 40 H.P., 3 phase, 60 cycle, 208-416 V motor.

1140 TON SOUTHWARK PRESS

Not Self Contained

Platen 11' 11" left to right, 11' front to rear. 48" stroke, 60" opening.

2000 TON BIRDSBORO PRESS

Self Contained

60" between rods left to right, 53" front to rear. Overall length of platen left to right 144". Stroke 30". Opening 36". 60 H.P., 3 phase 60 cycle, 220-440 V motor.

All Hydraulic equipment is completely engineered and checked by a competent staff, thus assuring reliability. Send us your hydraulic problems.

MISCELLANEOUS

Mitts & Merrill, Keyseaters
Wiedman Turret Punch—Type R4P
Buffalo #0 Angle Roll M.D.
Bliss #58-OB Gap Presses, 62, 62A, 162
6" Vertical Shaper, P & W
10x10 Peerless Universal Shaping Saw
#7, 72 Fellows Gear Shapers
Pexto 6' Power Shears
Burke & Nichols Millers, Pl. & Univ.
Delta Single & Multiple Drills
Deckel G1, G2, G1F Engraving machines
Hanson-Whitney Thread Miller
Oliver Heavy Duty die making machine
J & L bench comparator; Zeiss Shadowgraph
Taylor-Winfield 50 KVA Spot Welder
Leland-Gifford 1, 2 & 4 spindles, Model MS

AAron Machinery Co., Inc.

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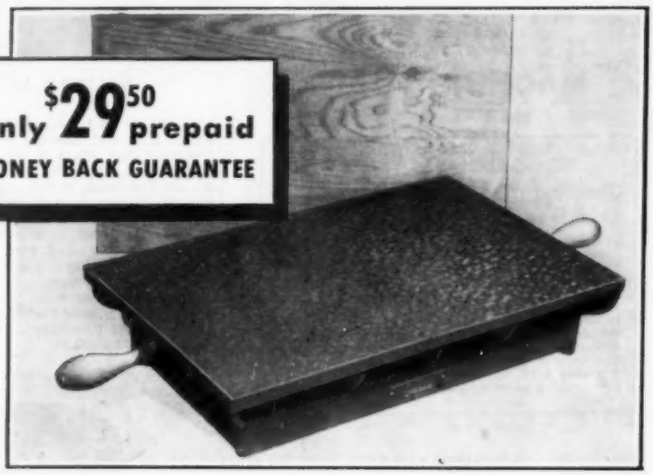
MDNA MEMBER

WO. 4-8233 **CABLE—AARMACH**

WAR SURPLUS

SURFACE PLATES

Precision surface plates. Finest quality Hand Scraped. Manufactured by CHALLENGE MACH. CO. Original factory packing. 12"x18" with ½" thick plate. 3" ribs. Complete with durable wooden protective cover and wooden handles. Made to strict gov't. specifications. *BRAND NEW!* A buy you can't afford to miss!



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MONEY BACK GUARANTEE

ANOTHER SURPLUS BARGAIN!

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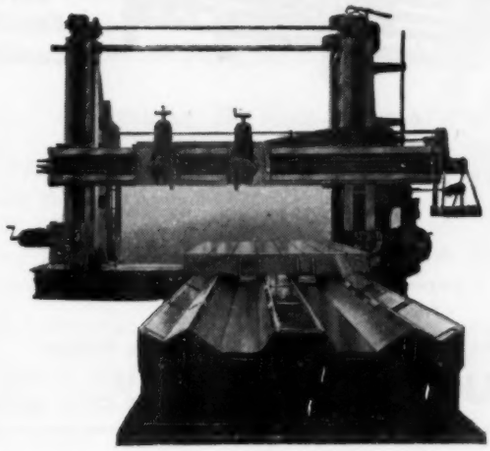

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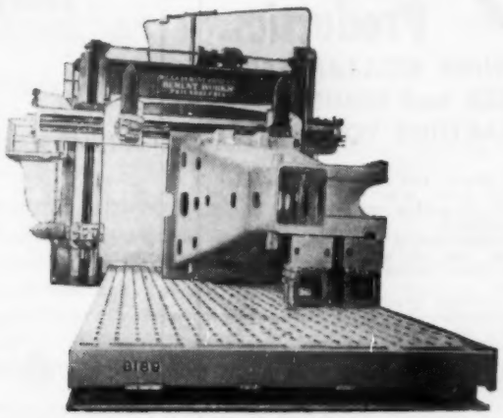

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Nos. 3, 4, & 5 W&S Ram Type Univ., M.D.
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W. C. Lipe 12"x18" Auto. Carbo-Lathe; sw. over bed 14"; dist. betw. cens. 18"; V-Belt motor drive, complete air cylinder and controls.

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Bullard 37" Vert. Bor. & Turn. Mill., with 2 swiv. heds. on cross rail; will take piece 40" in diam., motor driven, positive feeds.

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1—Dietrick & Harvey 36"x36"x16' Openside motor driven Planer complete with one hed. on cross rail, one side hed.: tbl. wkg. surf. 36"x16' 3"; max. hght. under cross rail 36"; dist. betw. uprights 36½".

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1—Midland No. 4 Univ. Ram Type Turret Lathe, late type, motor in base, sw. over ways 21½", hole thru spin. 2⅝", spin. speeds 12, 27-725 RPM.

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Fosdick "Economax" 4'13" col. Radial Drill; 36 spin. speeds, range 14 to 1010 RPM, No. 5 Morse Taper; motor driven.

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Two 6,000-Pound Steel Castings, 39" wide x 87" long, x 12" thick. Machined face very suitable for heavy duty work table.

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200 Ton Draw Pressure
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Have a number of 1" 6 spindle type RA *National Acme Automatics* like new *will trade for following;* 36" Van Norman *milling machine, Do all Saw, 42" Bullard,* 2A Warner & Swasey, #4 *milling machine, horizontal boring machine*—must be in good condition as our automatics.

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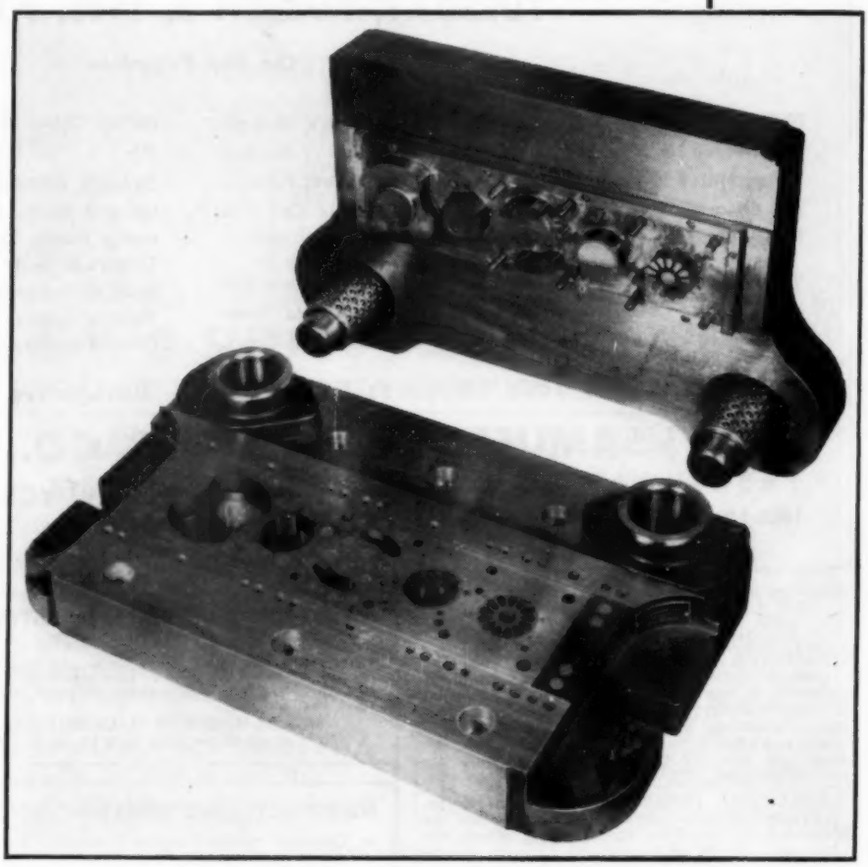

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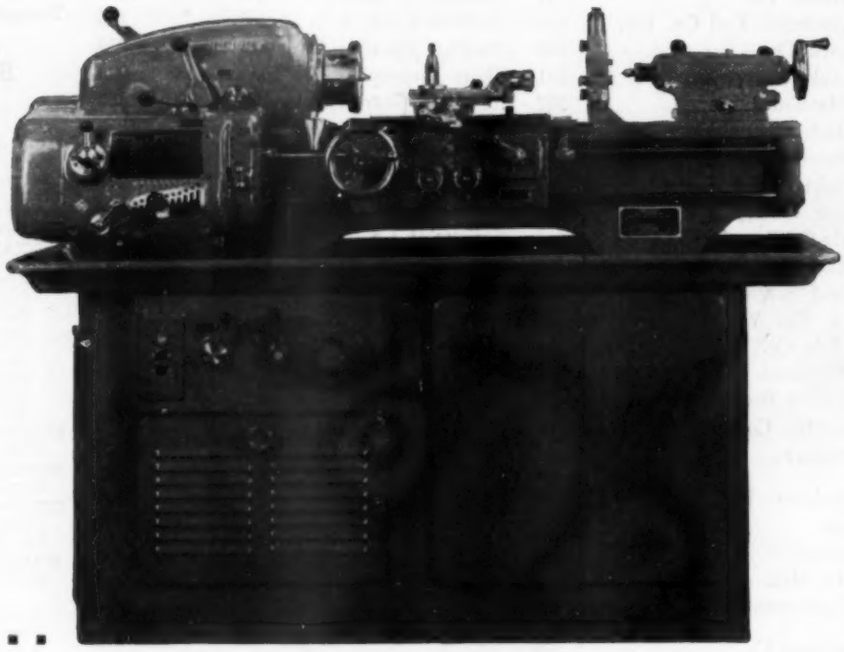

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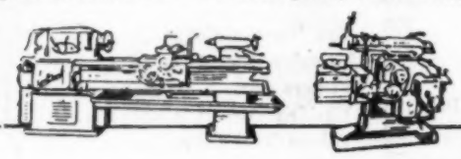

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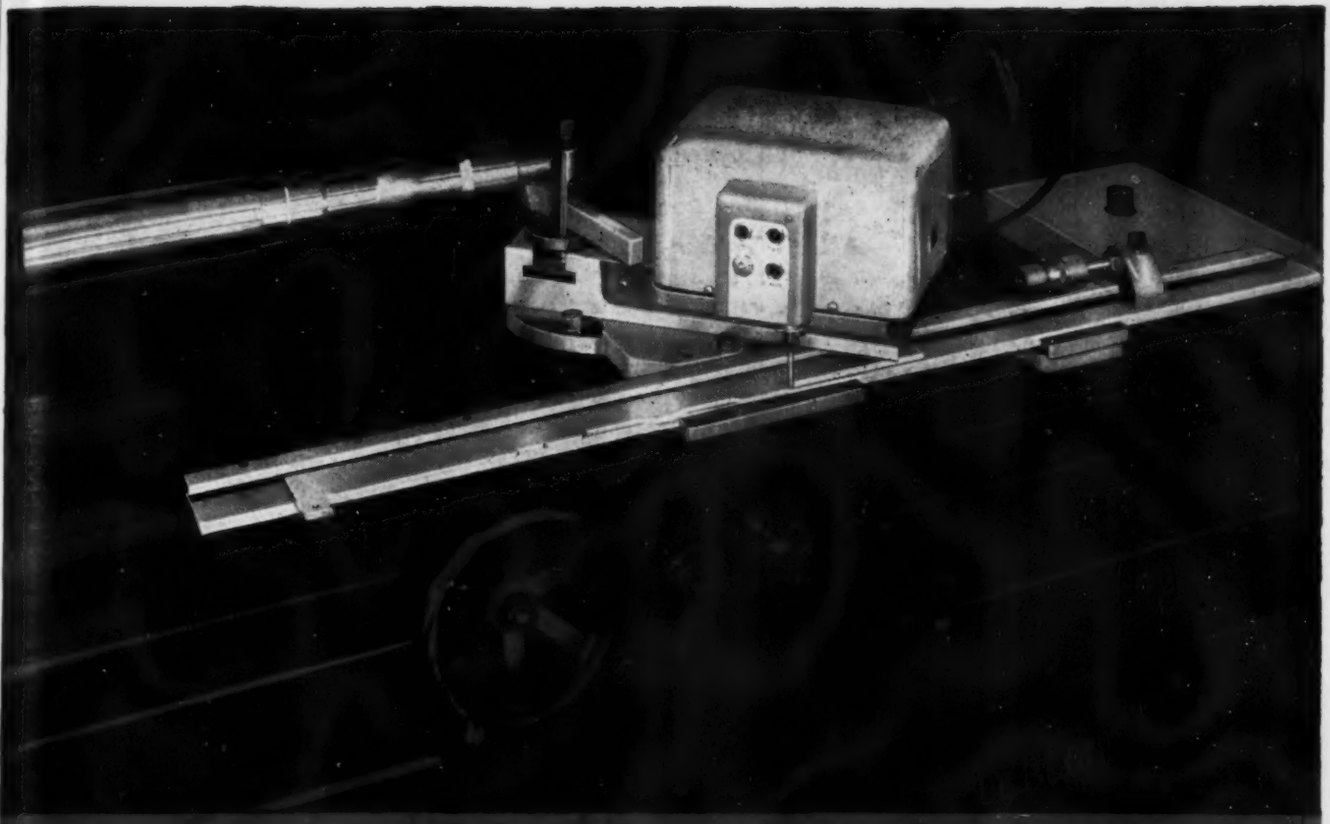

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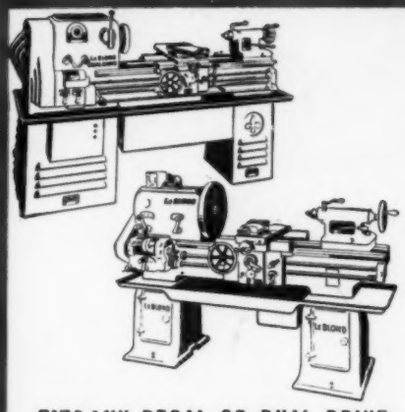

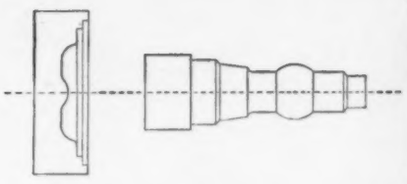

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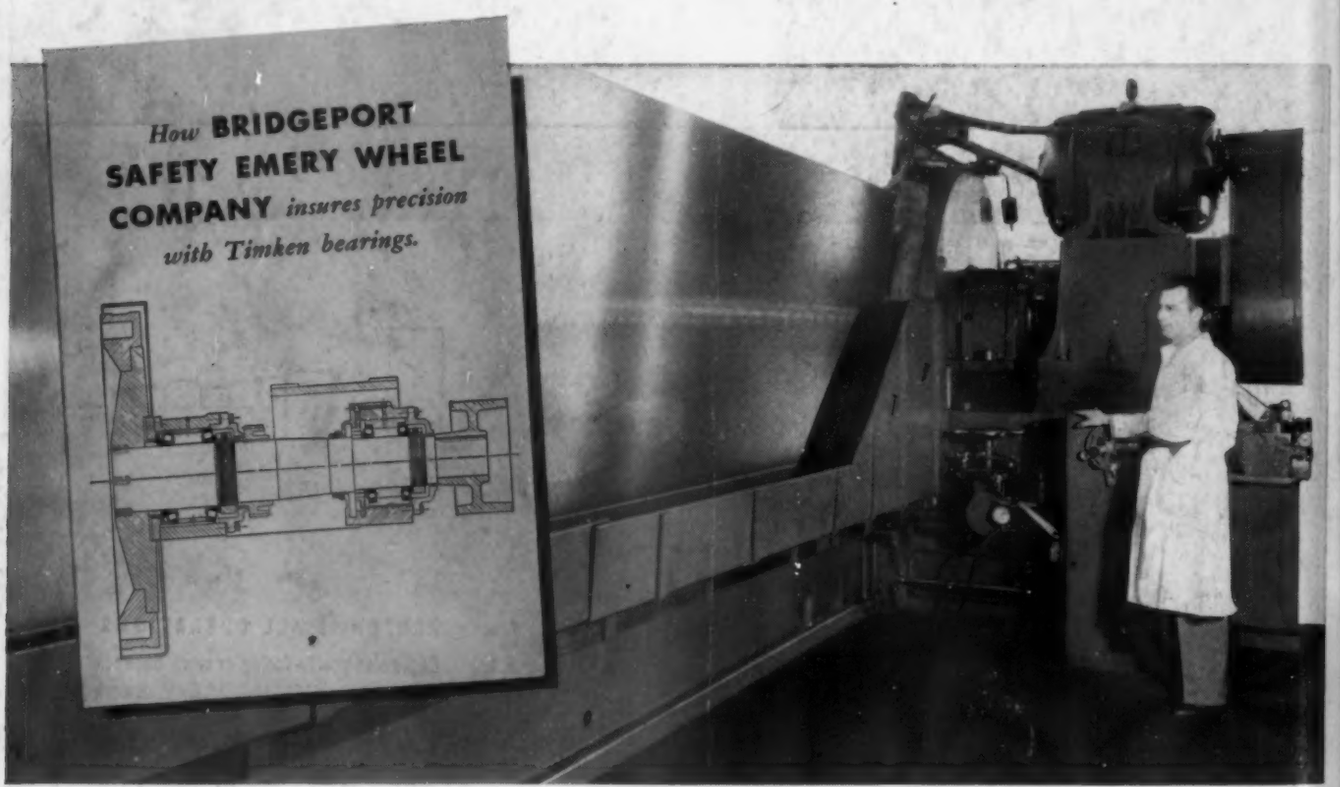

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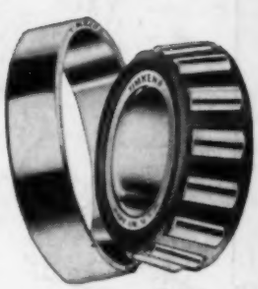
TRADE MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL — NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION